Soil and Water Conservation and Rural Livelihoods in the Upper Citarum Watershed in West Java, Indonesia.

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Miriam Andonie

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Leiter der Arbeit:
Prof. Dr. Hans Hurni
Betreuer der Arbeit:
Dr. Thomas Kohler

Centre for Development and Environment (CDE)

und Abteilung für Integrative Geographie (AIG)
Geographisches Institut

Preface

This master thesis was shaped within the World Overview of Conservation Approaches and Technologies (WOCAT) network, at the Centre for Development and Environment (CDE) and the Abteilung für Integrative Geographie (AIG) at the Institute of Geography of the University of Bern, as well as at the Ministry of Forestry in Indonesia. WOCAT is a worldwide network of Soil and Water Conservation (SWC) specialists contributing to Sustainable Land Management to prevent and reduce land degradation. WOCAT is financed by the Swiss Agency for Development and Cooperation (SDC), the Food and Agriculture Organization of the United Nation (FAO) and the World Soil Information Organization (ISRIC).

Mr. Syaiful Anwar was my very generous contact person in Jakarta. The possibility to work with the Ministry of Forestry of Indonesia allowed me to gain fieldwork experience in an area unknown to WOCAT. Due to this fact this paper represents a pilot study. This thesis is complemented by the master thesis of Cinzia De Maddalena, who was mapping the land use systems, erosion and conservation in the Sub watershed. The joint fieldwork for the present study was conducted in July and August 2010 in Java, Indonesia.

The work on this master thesis was a very challenging and interesting experience and would not have been possible without the support, assistance, translations, time and help of many persons and institutions. I would like to acknowledge my gratitude to all these persons.

I would like to thank Prof. Hans Hurni, the Centre for Development and Environment and the Abteilung für Integrative Geographie for the opportunity to gain fieldwork experience in Indonesia, especially the WOCAT team and Dr. Hanspeter Liniger. In particular I would like to thank Dr. Thomas Kohler for his excellent support in many terms. Thanks to him for the content and conceptual supervision, inspiring recommendations, advice and motivation! Further, I would like to thank Prof. François Jeanneret and his team for their helpful personal support.

I would to thank the Ministry of Forestry of Indonesia and Mr. Silver, without their help the fieldwork would not have been possible. Furthermore, I would like to thank Mr. Andé of the Department of Forestry of the province Bandung for his supportive information, assistance and the delicious coffees!

Last but not least, I would like to thank all the farmers for their friendliness, openness, patience and time. Without them and their hard work it would not have been possible to get the needed information in order to write this master thesis!

Very special thanks go to Mr. Syaiful Anwar and his family for the huge hospitality, friendship, openness and for the very pleasant stay in Jakarta. Thank you for the comforting words, I felt like I was at home!

Lastly I would like to thank my family and friends for their never ending support, regardless wherever on earth I am!

Summary

This study discusses the perception and motivations of the farmers to use **S**oil and **W**ater **C**onservation (SWC) technologies; a further question concerns the determining factors of the farmer` livelihoods, which are decisive for persuading them to implement SWC technologies. The research took place in the Sub Watershed Ciwidey of the Upper Citarum Watershed in the province West Java in Indonesia. The present paper is intended as a pilot study and can therefore be relied on for deeper studies.

The Upper Citarum Watershed comprises 227,446 ha (MINISTRY OF FORESTRY OF INDONESIA 2010) and is heavily affected by soil erosion, especially in the upper zones of the Sub Watershed Ciwidey, where one finds steep slopes and a partly dryer climate. Due to the high population pressure, farmers are forced into the drier upper zone, which is less suitable for agricultural production (PALTE 1989). This expansion and, due to this fact, the extensive use of the uplands lead to erosion and changing environmental conditions. Therefore the farmers are confronted with the challenge of adapting to these ecological changes (PALTE 1989).

The governmental motivations to combat soil erosion in the Upper Citarum Watershed are manifold. The region provides the drinking water for the capital Jakarta and includes three reservoir dams in the whole Citarum Watershed which provide Jakarta and the lowland with electricity and irrigation water. To prevent economic losses due to siltation of the reservoirs, various stakeholders are conducting programmes concerning SWC.

Some of the data underlying the present study was conducted during a field stay in summer 2010. In order to generate the data in question, twenty interviews with farmers of five different land use systems were held. Furthermore, expert interviews, observations and photography interpretation were carried out. The 14 technologies found in the field were documented by using the WOCAT form sheets.

The main result can be summarized as follows: The research area is largely conserved. A wide range in terms of the planted products, land tenure, land use and livelihoods is found. The information sources about SWC technologies used by farmers are very diverse, but family and cultural assets seem to be the most important sources. In addition many governmental efforts are being made in the research area. Due to the decentralization in 1998 the coordination of the SWC activities at the institutional level is satisfying. At large the SWC technologies seem to be successful and are perceived and valued as positive by the farmers. The farmer organizations are important in terms of information dissemination. The willingness of the farmers to learn more about SWC is high.

The study concludes that there is no relation between the livelihood assets and the number of SWC technologies in the farmers` fields. Nevertheless, human and social assets are increasing the number

of information sources on SWC technologies. It is recommended that farmer field courses are to be held, including the “non farmer organization members”, considering the fact that they are excluded from the information flow at this point of time.

Table of Contents

Abbreviations and Acronyms

ASGITA: Asosiasi Agribisnis Dan Wisata (see also Glossary)

BAPPEDA: Badan Perencana Pembangunan Daerah

BKP3: Organization of Food Endurance and Information Executor of Indonesia

BKSDA: Balai Besar Konservasi dan Sumber Daya Alam (see also Glossary)

BNB: Batu Namprak Bandung (see also Glossary)

BPDAS: DG Watershed Management and Social Forest

BUMN: State-owned Enterprises

CDE: Centre for Development and Environment

CSAR: Centre for Soil Agroclimate Research

DFID: Department for International Development

ESP: Environmental Services Program

EWO: Extension Worker Organization

FAO: Food and Agriculture Organization of the United Nations

FFI: Fauna and Flora International

GPS: Global Positioning System

GRLK: Gerakan Rehabilitasi Lahan Kritis (see also Glossary)

GWC: Green Water Credits

HCV: High Conservation Value

HCVF: High Conservation Value Forest

IPM: Integrated Pest Management

IRC: International Water and Sanitation Centre

ISO: International Organization for Standardization

ISRIC: World Soil Information Organization

ISSS: International Society for the Systems Sciences

KPH: Kesatuan Pemangkuan Hutan (see also Glossary)

KTH: Kelompok Tani Hutan (see also Glossary)

LADA: Land Degradation Assessment in Drylands

LDII: Lembagan Dakwah Islam Indonesia (see also Glossary)

LMDH: Lembaga Masyarakat Desa Hutan (see also Glossary)

LUS: Land Use System

NGO: Non-Governmental Organization

PHBM: Pengelolaan Hutan Bersama Masyarakat (see also Glossary)

PKBL: Partnership and Environment Mentoring Program

PTPN 8: Research Centre of State Company for Tea

REDD: Reducing Emissions from Deforestation and Forest Degradation in Developing Countries

SDC: Swiss Agency for Development and Preface Cooperation

SLH: Sustainable Livelihood

SLM: Sustainable Land Management

SLPHT: Sekolah Lapangan Pengendalian Hama Terpadu (see also Glossary)

SWC: Soil and Water Conservation

TFT: Tropical Forest Trust

TNC: The Nature Conservancy

UNCOD: United Nations Conference on Desertification

UNDP: United Nations Development Programme

UNEP: United Nation Environment Programme

UPSA: Unit Percontohan Sumber Dayer Alam (see also Glossary)

UPT: Technical Implementation Unit

USAID: United States Agency for International Development

WASWC: World Association of Soil and Water Conservation

WOCAT: World Overview of Conservation Approaches and Technologies

WWF: World Wide Fund for Nature

Glossary

Asosiasi Agribisnis Dan Wisata:	Agribusiness and Tourism Association
Badan Perencana Pembangunan Daerah:	Regional Development Planning Agency
Balai Besar Konservasi dan Sumber Daya Alam:	Centre for Conservation and Natural Resources
Batu Namprak Bandung:	Stone Group Bandung
Desa:	Village
Dinas Bandung:	Local government of Bandung
Gerakan Rehabilitasi Lahan Kritis:	Rehabilitation Program of Critical Land
Hari Krida Pertanian:	Agricultural Day
Java Barat:	West Java
Kabupaten:	Regency
Kecamatan:	Sub district
Kelompok Tani Hutan:	Forest Farmer Groups or Cooperatives
Kementerian Kehutanan:	Ministry of Forestry of Indonesia
Kesatuan Pemangkuan Hutan:	Unity Forest Concession
Lembaga Masyarakat Desa Hutan:	Forest Village Community Institutions
Pengelolaan Hutan Bersama Masyarakat:	Joint Forest Management Society
Perhum Perhutani:	State-owned Enterprise in the Secondary Forest
Sekolah lapang:	Farmer field school
Sekolah Lapangan Pengendalian Hama Terpadu:	Integrated Pest Management Field School
Sub Das:	Sub Watershed
Tumbang sari:	Agroforestry
Unit Percontohan Sumber Dayer Alam:	Pilot Unit of Natural Resources

1 Introduction

1.1 Problem Definition and Background

According to ESWARAN ET AL. (2001) the global annual loss of soil due to natural and **anthropogenic** factors constitutes 75 billion tons per year. Further land degradation is defined as a decline in land quality or a reduction in its productivity. Soil erosion will remain a very important global issue for the 21st century because of its adverse impact on agronomic productivity, the environment, and its effect on food security and the quality of life. "The productivity impacts of land degradation are due to a decline in land quality on site where degradation occurs (erosion) and off site where sediments are deposited" (ESWARAN ET AL. 2001). Furthermore, the battle against soil degradation and desertification is also crucial from an economic point of view considering the high productivity impacts and losses. ESWARAN ET AL. (2001) estimates the global monetary loss due to soil erosion at 400 billion US Dollars per year respectively 70 US Dollar per person per year.

Within the work against soil degradation and its impacts, sustainable land management is one solution among many. For example, WOCAT (World Overview of Conservation Approaches and Technologies) detects and collects sustainable land management practices all over the world and puts them into an online database. Thereby it contributes to the fight against land and soil degradation and desertification, given that this database and other tools help SLM specialists to find appropriate SLM technologies and approaches in order to support the specialists in making decisions in the field and at the planning level. WOCAT`s vision is to improve land and livelihood through information and knowledge sharing on sustainable land management (see also the web page of WOCAT: http://www.wocat.org/).

A large surface of the Sub Watershed Ciwidey, in the Upper Citarum Watershed in the province West Java in Indonesia, is degraded. 8830 ha or 39, 8 percent of the surface are classified as 'very badly eroded' by the MINISTRY OF FORESTRY OF INDONESIA (2010). The livelihoods of many persons in this region are endangered, especially the livelihoods of the poor, small- scale farmers in the rural area of the upper zones. According to HARDJONO (2005), the extensively used upland and plantation agriculture, which still play a role in the land use system, are reasons for the problems of soil degradation in West Java. Further reasons are: the very poor results of the reforestation programmes carried out by the government of Indonesia which owned land in the past, the policy of the state-owned enterprise called Perhum Perhutani (see Chapter 4.4.3.1) which allows cultivators to intercrop vegetables between rows of newly planted trees, which inhibit the growth of the trees. The expansion of horticulture on steep slopes, which before were forested or planted with perennials,

and the fact that developers converted arable land into building sites also contribute to the land degradation.

Conservation activities in the study area are motivated by the fact that first, the population of the province and especially of the Sub Watershed Ciwidey is practicing subsistence agriculture and depends on the soils. Second, rural poverty is widespread. The absolute number of poor people 2010 in the province West Java amounts to 4.8 million persons or 11.27 percent of the population (STATISTICS INDONESIA 2009). The average poverty line is 22 US Dollar per month. According to ESWARAN ET AL. (2001) poverty can be an important cause of land and environmental degradation as farmers have to use unsuitable soil to intensify their productivity in order to make their living; contrariwise soil conservation can help reduce poverty. Third, there is a big population pressure on the natural resources in this area, which presents a major challenge for food security. West Java is the most densely populated province on the economically and politically most important island Java. (The population of West Java amounts to 43 million people. Due to this population the existing agriculture grows, is intensified and the land is often treated unsuitably.) Also the production of cash crops for export can lead to an intensified agriculture. Fourth, the province of West Java depends on agricultural production. Its total harvested area in 2009 was 2.4 million ha or 53 percent of the whole area (STATISTICS INDONESIA 2009). Additionally the province provides food for the capital, Jakarta. Thus, it contradicts the western perception of human rights.

There are two further facts, which motivated the government to engage in soil and water conservation. First, the Upper Citarum Watershed provides drinking water for the capital Jakarta (8.8 millions of inhabitants, according to DER FISCHER WELTALMENACH 2010). Maintaining the quantity and quality of the water supply is therefore very important. Second, there are three reservoirs, which provide electricity to the capital. The impacts of soil and land degradation have an effect on the water reservoirs, electricity generation and drinking water supplies. Due to the high erosion rates in the Upper Citarum Watershed, a big sediment cargo is fed into the reservoirs every year, which leads to their siltation. Soil erosion from the Sub Watershed Ciwidey amounts to 12, 5 million tons per year and the sediment cargo is more than one million tons per year that is fed into the Saguling reservoir (MINISTRY OF FORESTRY OF INDONESIA 2010). Due to siltation the function of the reservoir dam is constrained and electricity production decreases. In addition, there are rising costs due to the fact that the reservoir has to be de-silted.

My motivation to do this study was to get involved more deeply into the region of West Java in Indonesia. I had already travelled to Indonesia and the island of Java in 2005. At the time I was very fascinated by the cultural and linguistic variety and above all by the biological diversity of this region. Therefore the need to protect and conserve all of this seemed very important to me. Moreover, during my studies at the University of Bern, I became interested in the concept of sustainable land management and the issue of food security. To me, food security and safe drinking water are basic human rights, which everyone should have access to. For these reasons WOCAT and its long-term idea to improve the rural livelihoods, while at the same time conserving the soils became one of the foci of my study interests.

1.2 Research Area

The present research was conducted in the Upper Watershed of the Citarum River in the province of West Java (Java Barat), located on the island of Java. Further a smaller area was chosen- the sub watershed in the sub district (*kecamatan*) Ciwidey, which is located in the regency (*kabupaten*) of Bandung and contains seven villages (*desa*). I will introduce the study area step by step from the national to the local level and in addition describe the Citarum Watershed.

1.2.1 Indonesia

Indonesia is the biggest insular state in South East Asia, regarding the area as well as the amount of inhabitants. According to FISCHER WELTALMENACH (2010) Indonesia, with an area of 1,912,988 km^2, ranks 15th among the largest countries in the world. According to the STATISTICS INDONESIA (2009) the population amounted to 238 million inhabitants in 2010 and the capital Jakarta alone hosts more than 9 million citizens. For the year 2010 the UNDP predicts a population of 254 million. The two biggest ethnic groups are the Javanese with 42 percent and the Sundanese with 15 percent (see Box 1.1). Indonesia has 37 provinces and 17,508 islands, among which 6,044 are inhabited (Indonesian Naval Hydro-Oceanographic Office in EMBASSY OF THE REPUBLIC OF INDONESIA, WELLINGTON, NEW ZEALAND 2008). The economically and politically most important island Java, comprises five provinces: Banten, West Java, Central Java and East Java and two special districts Jakarta and Yogyakarta.

With regard to the Human Development Index of the UNDP (2010), Indonesia lags behind the global average (0.634) as well as the average of East Asia and the Pacific (0.65). According to the UNDP the HDI of Indonesia in 2010 amounted to 0.600 (Figure 1.1). “Between 1980 and 2010 Indonesia's HDI rose by 1.4 percent annually from 0.390 to 0.600 today, which gives the country a rank of 108 out of 169 countries with comparable data” (UNDP 2010). I suppose that the diversion of the average HDI of the East Asia and the Pacific 1990 correlates with the immense economic growth of China.

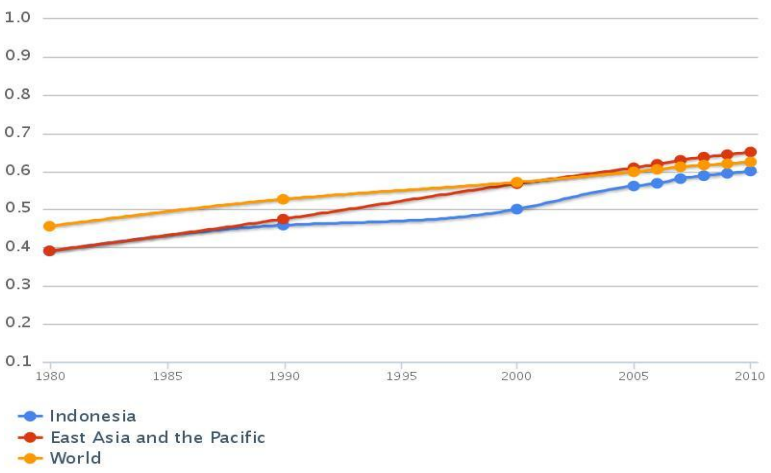


Figure 1.1: Human Development Index: Trends of the index of Indonesia, East Asia and the Pacific and the World between 1980 to present (UNDP 2010).

1.2.2 West Java and the District Bandung

The capital of the West Java province, in Indonesian Java Barat and Sundanese Jawa Kulon, is Bandung with a population of 2 288 570 (DER FISCHER WELTALMENACH 2010). In the west the province borders on Jakarta and the Banten province and on the east on Central Java. In the north there is the Java sea and in the south the Indian Ocean. According to the official website of the REPUBLIC OF INDONESIA (2010) the area of West Java counts 44,354.61 km^2. The North is low, while the southern region is a little hilly and constitutes the mountainous coastal plateau in central region with a height of more than 1,500 meters above sea level. The climate in West Java is tropical, with temperatures of 9 degrees Celsius on the top of Mount Rinjani and 34 degrees Celsius on the North Coast. The rainfall average is 2,000 mm per year, but in some mountainous areas it even reaches between 3,000 and 5,000 mm per year. The regency Bandung contains 27 villages and the area size amounts to 2,000.91 km^2. According to REPUBLIC OF INDONESIA (2010) the number of residents is about 4 million and the population density is 2,066 inhabitants per km^2.

According to the headline of the THE JAKARTA POST (2010), Sonny Harry Harmadi, director of the Demographic Institute of the University of Indonesia, stated by referring to the 2010 census, that the population of West Java amounts to 43 million and is the most densely populated province. Further he says West Java`s population growth rate is at 2 percent and is therefore the highest among all provinces in Java. Sonny Harry Harmadi declared that West Java is choking under the weight of its people because the province is an outlier, within which Greater Jakarta`s population overflows. Furthermore he made clear that the population explosion in West Java, if unchecked, would pose a threat to the country`s food security, adding that the province was the country`s food bowl. According to the STATISTICS INDONESIA (2009) the population growth is decreasing slowly and remains

at a high level. From 1971 to 1980 the growth rate was 2.66 percent, in the period 1981 to 1990 it was 2.57 percent and in the last decade the growth rate was 2.03 percent.

Further according to STATISTICS INDONESIA (2009) the absolute number of poor people 2010 in the province of West Java was 4,773,700, that's 11.27 percent of the whole population in this province. Of these people, 2,350,500 live in an urban, 2,423,200 in a rural area. According to these figures, more poor people live in the rural areas than in cities. Consequently it can be assumed that many poor people depend on agricultural subsistence production. The average poverty line of the urban and rural area in the province West Java is 201,138 Indonesian Rupiah or 22 US Dollar a month.

The GDP of the province West Java amounted to 67 billion US Dollar in 2009 (STATISTICS INDONESIA 2009).

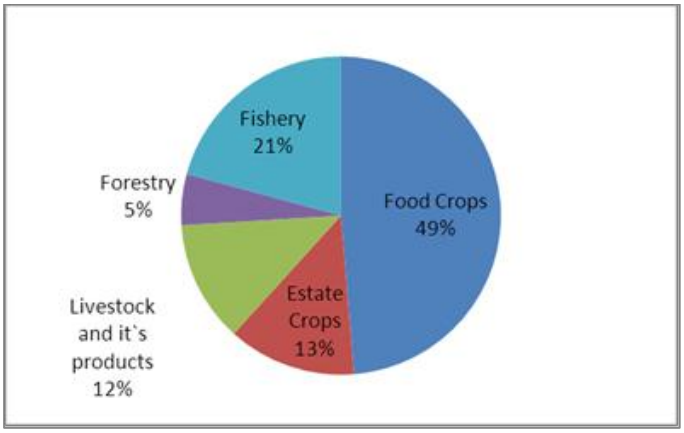


Figure 1.2: Percentage distribution of the first sectors` products of the Indonesian agriculture in 2009. Own compilation. (Data source: STATISTICS INDONESIA 2009).

Food crops make 49 percent of the first sector production (Figure 1.2). The agricultural food crop production 2009 in Indonesia (Table 1.1) manly consisted of paddy rice (64,398,890 tons), cassava (22,039,145 tons) and maize (17,629,748 tons). In order to get a more accurate picture of West Java a closer look at the 44,354.61 km^2 area is necessary. In 2009 this province produced 11,322,681 tons of paddy rice, 787,599 tons of maize and 2,086,187 tons of cassava. Other food products are soybean, peanut, mungbean and sweet potato. In 2009 the total harvested area in West Java amounted to 2.4 million ha or 53 percent of the whole area. West Java shows high productivity in comparison to the other 32 provinces. In the paddy rice production, productivity occupies rank three, in the case of cassava, productivity is on rank five and in the case of maize productivity even occupies first place. (STATISTICS INDONESIA 2009)

According to the FEDERAL OFFICE OF STATISTICS GERMANY (2009) 2006 about 52 million people were working in the agricultural sector.

	INDONESIA (tons)	WEST JAVA (tons)
Paddy	64,398,890	11322,681
Cassava	22,039,145	2086,187
Maize	17,629,748	787,599
Sweet potat	2,057,913	469,646
Soybean	974,512	60,257
Peanut	777,888	89,454
Mungbean	314,486	16,195

Table 1.1: Agricultural food crop production of Indonesia and the province West Java. The graph shows the total production of the Indonesian and West Java's share. Own compilation. (Data source: STATISTICS INDONESIA 2009).

1.2.3 The Upper Citarum Watershed

Like the name indicates, the Upper Citarum Watershed is the uppermost part of the whole Citarum Watershed on the island Java in the province West Java. Further it can be divided into eight Sub Watersheds: the Cikapundung-Cipamokolan, Cikeruh, Cisangkuy, Citarik, Cirasea, Ciwidey, Ciminyakand Cihaur (see Figure 1.3). The Upper Citarum Watershed is the water reservoir and electricity source of the capital Jakarta, which is situated on the coast of the Java Sea. 56.24 percent of the Upper Citarum Watershed belongs to the administrative district of Bandung. The watershed is embedded in a hilly landscape of the backcountry of Jakarta. The whole area is 230,802 ha and 26,000 km wide. (LUCC 1998)

The spatial distribution of the rainfall is not consistent. Due to the extremely mountainous terrain and its topographic effect, the average annual rainfall varies from 1966 mm up to 2600mm. Java`s location between the Indian and the Pacific oceans as well as between the Asian and Australian land mass, exposes the island to the greater movements of moist air, called monsoons. According to Köppen the study area is in the Am (tropical rain forest climate despite a short dry season according to the monsoon-type precipitation cycle). Only some parts at the highest altitude were classified as Cfa (warm temperate climate, moist, with precipitation in all months, with a hot summer, warmest month over 22 degrees Celsius). Because Köppen`s system has no practical purpose and because, in fact precipitation in Indonesia undergoes considerable variations from year to year, in 1950 a national working group was established to construct a climatic map suitable for practical application, namely the Schmidt and Ferguson concept. This system takes the number of dry and wet months into consideration. The Upper Citarum Watershed lies in the climatic zone A (no dry month) and B, while Ciwidey in assigned to the zone A. The rainy season in the Upper Citarum Watershed is from November to April and the remaining months are the so-called transition or dry season. There is a huge amount of rainfall from the beginning of March until April and the second peak is from November until December. (DONNER 1987)

According to the MINISTRY OF FORESTRY OF INDONESIA (2010), the daily average temperature is between 22 and 23 degrees Celsius and the average wind speed in a month lies between 23 and 106 km per hour. Further the atmospheric humidity is between 25 and 83 percent.

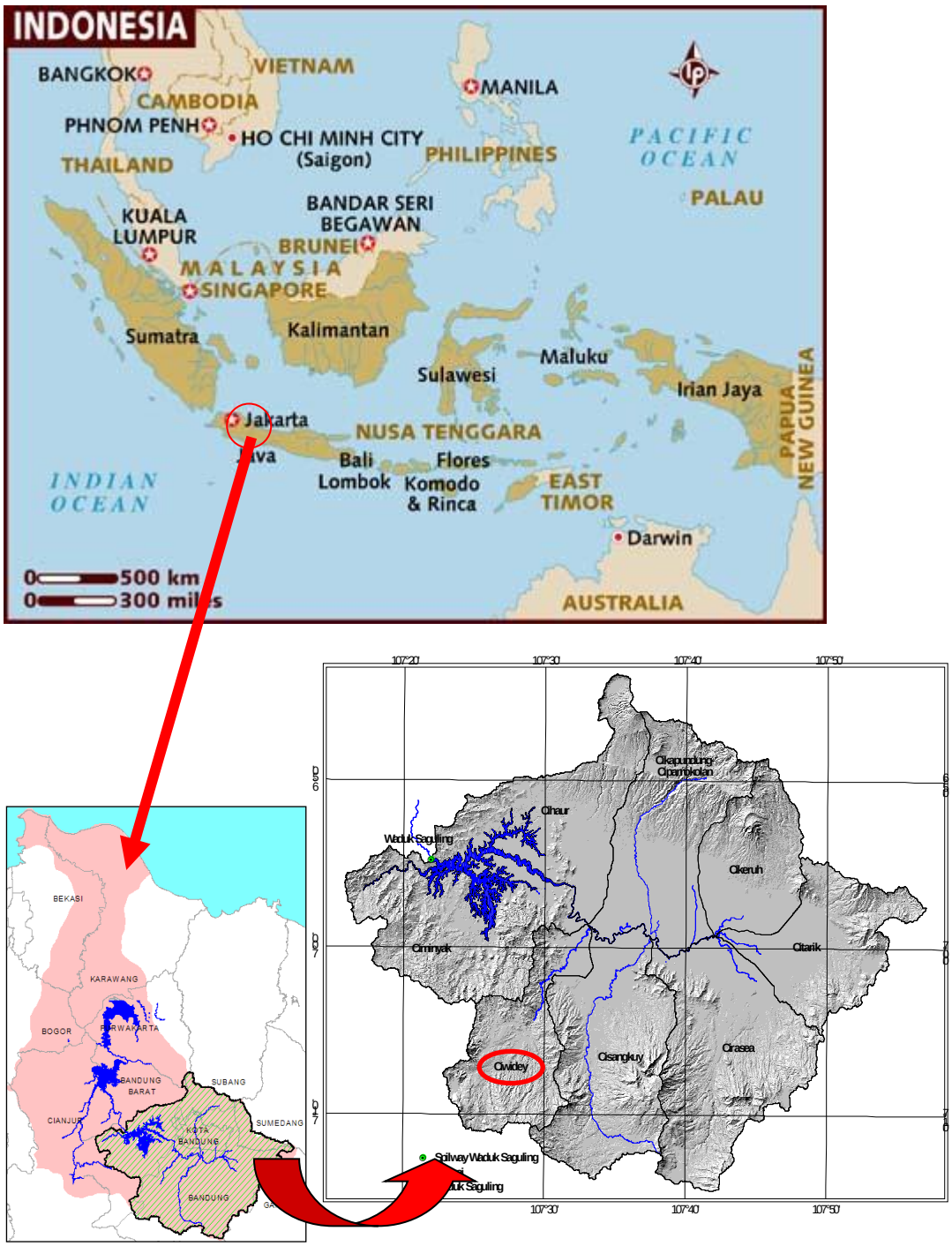


Figure 1.3: The research area is located on the island Java, more precisely in the province West Java. Below left, the whole Citarum Watershed is mapped; the three reservoirs and the Citarum River estuary in the north can be easily recognized. Below right is the Upper Citarum Watershed, divided into the seven Sub watersheds. The Sub watershed Ciwidey is situated in the south (MINISTRY OF FORESTRY OF INDONESIA 2010 and TWYGGY 2011).

1.2.4 The Sub Watershed Ciwidey

The Sub Watershed Ciwidey (*sub das Ciwidey*) is divided into seven different sub- districts: Katapng, Soreang, Pasir Jambu, Ciwidey, Cililin, Banjaran und Pangalengan. According to the MINISTRY OF FORESTRY OF INDONESIA (2010), the Sub Watershed of Ciwidey presents a slope of 0 percent in the north and slopes up to 40 percent in the mountainous South near the Kawah Putih volcano (2400 meter above sea level). The whole area of the sub watershed amounts to 22,165 ha whereas 8,958 ha (40.41 percent) are covered by forest. The forest area is found especially in the southern part and consists of primary and secondary forest. The soils are above all Dispropept (72 percent) and Palendult (20 percent), further we find some Hidraquents and some Eutropepts. The administrative office of the Upper Citarum Watershed is in Bogor.

According to the Ministry of Forestry of Indonesia 2010, the surface flow of the Sub Watershed Ciwidey amounts to 389.1 million m^3 per year. According to the classification of the Ministry of Forestry 8,830 ha of the whole land (22,169 ha) – namely 39.8 percent are under the condition "very bad erosion". The erosion amounts to 12.5 million tons per year and 566 tons per ha per year. The sediment cargo is 1 million tons per year and flows into the Saguling reservoir (MINISTRY OF FORESTRY OF INDONESIA 2010). The soil erosion of 56 kg/m^2 in the whole area is hardly conceivable. The impacts of this movement would be very big. According to HUDSON (1981), the upper limit of tolerable soil loss, which has for many years been taken in the United States, is 11.2 tonnes per ha per year and that proves that the erosion number is far too high. The highest number of soil loss of seven research sites in Eritrea, Africa, conducted on test plots amounted to 212 tons per ha per year (OGBAZGHI and STILLHARDT 2010).

No	Sub Watershed	Area (Ha)	Soil Erosion (ton/ year)	Sediment Yield (ton/ year)
1	Cihaur	27,981	11,212,448	857,446
2	Cikapundung-Cipamokolan	30,472	13,698,610	1,023,347
3	Cikeruh	19,029	6,659,086	569,293
4	Ciminyak	32,575	15,443,496	1,132,739
5	Ciangkuy	38,110	18,403,774	1,332,692
6	Ciarea	34,159	24,930,983	1,755,517
7	Citarik	22,951	9,441,560	773,001
8	Ciwidey	22,169	12,556,520	1,023,891
9	Water body (Reservoir)	3,356		

Table 1.2: The Sediment results of the different Sub Watersheds (Sub DAS) of the Upper Citarum Watershed in West Java and its total. For the locations of the Sub Watersheds see map. All sediment results end in the reservoir Saguling downstream which is very important for the drinking water and the electricity production of Jakarta. (Data source: MINISTRY OF FORESTRY OF INDONESIA 2010).

BOX 1.1. Culture

Despite increasing religious conflicts in Indonesia, the tolerance between the different religions seems to be high; in any case in the research area and the whole island Java. This tolerance seems to come from the huge diversity of Indonesia due to of the high amount of islands, on which many different cultures were developed separately. Also the biodiversity and the linguistic diversity are very high. Besides the official language Bahasa Indonesia there exist more than 300 different regional languages and dialects. (BERLIN.DE 2011)

However, the Pancasila (Principles of the national Ideology and Constitution of the Republic of Indonesia, which should have a identity forming and homogenizing effect in this multiethnic state) accepts five different world religions, to one of them everyone has to confess oneself (Islam, Christendom (catholic and evangelical), Buddhism, Hinduism or Confucianism). Although Indonesia is with circa 200 million Moslems (88 percent the state with the biggest Muslim population in the world, Islam is not the state religion. Many of the Indonesians are practicing a syncretistic form of the Islam and some ethnic groups' state to belong to an official religion, while practicing an animistic believe. Nine percent (23 million) are Christians, 1.8 percent of the population are Hindus and one percent are Buddhists. The traditional ancestor cult and the belief in spirits are playing still an important role (above all in the rural Java) although they are Moslems, Christians or Buddhists. (DIG 2009)

In the field I could observe a good and mutual tolerance between the different religions and mutual helpfulness between everyone. This helpfulness and understanding for others are, according to the interview with Memet, the key farmer and NGO holder (2010) rooted in the Islam. Asking the farmers and experts what the main idea of the practicing Ramadan should be, one of the reasons named was that the people can understand and experience on their own body what it means to be poor and have not enough food. It should enforce the solidarity with the poor.

1.3 Aims of Research and Research Questions

This study makes a contribution to WOCAT and its efforts against soil and environmental degradation. As a Master thesis, my research is a pilot study and generates information about the region in terms of soil and water conservation. On the basis of this research, further, more accurate studies can be written. The aim was to document which SWC technologies were used in the research area, which approaches were used for their implementation and finally to put this information into the WOCAT online database. A second aim was to find out why the farmers practice SWC, in order to understand their motivation and needs. Another motivation for this research was to build up contacts to the Ministry of Forestry in Indonesia, considering that it wants to become a WOCAT partner. Additionally, expansion into a tropical country was found to be very interesting for the WOCAT network.

In a second, a more holistic approach, the farmer`s livelihoods were studied. I tried to find out if livelihoods influence the decision making for or against SWC. Where links were found, they are presented and used to provide recommendations for policy advice, and for helping to arrange SWC more effectively and to implement SWC technologies sustainably.

Specifically the research questions therefore are:

1. Which SWC technologies are used in the research area?
2. Which approaches are used for implementation?
3. What are the reasons for the farmers to practice SWC?
4. Which are the characteristics of the farmers' livelihoods?
5. What are the links between livelihoods and the implementation of SWC at the household level?

As the theoretical framework helped to interpret and analyse the data collected in the field, I will first discuss the theoretical framework and later present the findings in the field.

For the synthesis in Chapter 5, I formulated two different hypothesises which are the following:

1. If a farmer has higher capital (according to DFID 1999) values, this farmer has also more SWC technologies used in his fields.
2. If a farmer has higher capital (according to DFID 1999) values, this farmer has also more information sources.

Further there were used two assumptions:

1. To use a higher amount of SWC technologies leads to a better conserved field and is therefore always required.
2. That more information sources about SWC technologies leads to a higher and more conscious application of SWC technologies and further to more sustainable agriculture and less soil degradation and a sustainably used ecosystem.

In Chapter 5 this hypothesises and assumptions will be discussed.

2 Theoretical foundations

2.1 Conceptual Frameworks

For this research two frameworks are used: the WOCAT framework and the DFID Sustainable Livelihood Framework. To answer the first two research questions of the study (formulated on page 12) concerning land and soil degradation and SWC technologies and approaches, the WOCAT framework was applied. For the third and fourth research question the DFID Sustainable Livelihood Framework was used.

2.1.1 Land and Soil Degradation in General

Numerous terms and definitions exist among land and soil degradation and desertification. According to ESWARAN ET AL. (2001), while there is a clear distinction between *soil* and *land*, there is no clear distinction between the terms *land degradation* and *desertification*. The term *land* refers to an ecosystem, comprising land, landscape, terrain, vegetation, water, and climate (ESWARAN ET AL. 2001). *Soil* is defined as: "The upper layer of the earth`s crust composed of mineral parts, organic substance, water, air and living matter. Soils are the result of interactions between the inherent nature of parent material, the prevailing environmental conditions and human activities" (ISO 1996 in CHOUDHURY AND JANSEN 1998). In chapter 1, of part 2 these three terms (land degradation, soil degradation and desertification) will be explained and discussed.

"**Land Degradation** implies reduction of resource potential by one or a combination of processes acting on the land. These processes include water erosion, wind erosion and sedimentation by those agents, long-term reduction in the amount or diversity of natural vegetation, where relevant, and salinization and sodication" (UNEP 1992 in FAO 2002). The mechanisms initiating land degradation include physical, chemical, and biological processes (Lal 1994 in ESWARAN ET AL. 2001). The definition of the programme Land Degradation Assessment in Drylands (LADA) contains the term of ecosystem goods and services and therefore is an important one: "Land degradation is the reduction of the capacity of the land to provide ecosystem goods and services and assure its functions over a period of time for the beneficiaries of these" (FAO 2011) Further the definition of International Organization for Standardization (ISO) adds the fact that land degradation is often induced by human activities and addresses the economic and ecologic function of the land (ecosystem services): "Degraded land has been defined as land, which due to natural processes or human activity is no longer able to sustain an economic function and/or the original ecological function properly "(ISO 1996 IN CHOUDHURY AND JANSEN 1998). In my research and in the context of sustainable land management, agriculture and the

WOCAT network, a main focus is set on land degradation caused by human activities. Beinroth et al. 1994 in ESWARAN ET AL. (2001) includes human actions into the term of land degradation, stating that in the context of productivity, land degradation results from a mismatch of land quality and land use. The farmers are using the land inappropriately to the existing land quality.

WOCAT (2007) also uses the definition of ISO and further explains the different land degradation components, all of which may contribute to a decline in agricultural production and other ecosystem services:

- **Soil degradation**- decline in the productive capacity of the soil as a result of soil erosion and changes in the hydrological, biological, chemical and physical functions of the soil. The major types include water erosion (such as inter-rill erosion, gully erosion, mass movement, off-site sedimentation), wind erosion, chemical erosion (such as fertility decline, reduced organic matter, acidification, salinization, soil pollution) and physical deterioration (such as soil compaction, surface sealing and crusting, waterlogging).
- Vegetation degradation- decline in the quantity and/or quality (species composition, diversity, etc.) of the natural biomass and decrease in the vegetative ground cover.
- Water degradation- decline in the quantity and/ or quality of both surface and groundwater resources (such as acidification and soil moisture problem).
- Climate deterioration- changes in the micro- and macro-climatic conditions that increase the risk of crop failure.
- Losses to urban/ industrial development- decline in the total area of land used, or with potential for agricultural production as a result of arable land being converted to urban, industrial and infrastructure uses.

ISSS 1996 in other words says that soil degradation is characterized by the decline in soil qualities commonly caused by the improper use by humans (FAO 2002). This definition already contains the soil erosion happening through anthropogenic use.

Further according to UNCOD 1997 in FAO (2002) the definition of the United Nation Environmental Program (UNEP) that in 1991, defined **desertification** as land degradation in arid, semi- arid, and dry sub humid areas resulting mainly from adverse human impact, already constitutes a revision of the definition formulated at the United Nations Conference on Desertification 1977. This older definition defined desertification as the diminution or destruction of the biological potential of the land, which could ultimately lead to the formation of desert-like conditions (UNCOD 1997 in FAO 2002). According to ESWARAN ET AL (2001) many researchers argue that the definition of UNEP is too narrow

in terms of the regions and should also be extended to temperate humid regions and to humid tropics as severe land degradation resulting from anthropic activities can also occur there.

2.1.2 WOCAT (World Overview of Conservation Approaches and Technologies)

WOCAT is a global network of **S**oil and **W**ater **C**onservation (SWC) specialists, contributing to sustainable land management. According to WOCAT (2011), their vision is to improve land and livelihoods through sharing and enhancing knowledge about sustainable land management. In 1992 the international programme WOCAT was initiated as a programme of the World Association of Soil and Water Conservation (WASWC) to link its members in order to enable them to work together towards a common goal (Hurni, Director CDE, University of Bern, Switzerland in WOCAT 2007). WOCAT sets its focus on positive practices of **S**ustainable **L**and **M**anagement (SLM) and (SWC) technologies. The network tries to collect the data of the different SWC technologies found in the fields and put them into an online database. This database should help small- scale farmers and experts to find solutions against land degradation, convert their land into a better ecological condition and combat desertification. In the book "Where the land is greener", WOCAT published some of their case studies on SW technologies all over the world as well as, if included, the corresponding approaches for policy consulting. Besides this online database WOCAT supplies many other tools, for example several questionnaires.

Sustainable Land Management (SLM) /Sustainable Agriculture

According to WOCAT, SLM means to use the land resources, including soil(s), water, animals and plants, for the production of goods to meet changing human needs, while simultaneously ensuring the long-term productive potential of these resources and ensuring their environmental functions (WOCAT 2007).

In the soil and water conservation handbook by UNGER (2006) sustainable agriculture or sustainability ensures the availability and productivity of the natural resources, for continued use by present and also by future generation. The resources are seen, by including the future generation, in a long-term scale. Further the definition contains, besides conservation of the soil and other resources, the requirement to minimize or avoid environmental degradation. The management practices have to be technically appropriate, economically viable, and socially acceptable and ensure the sustained productivity of natural resources.

According to Prof. Dr. Hurni, Director CDE, University of Bern, Switzerland, farming remains the dominant occupational sector in the global economy and over one billion people are engaged in agriculture, and about 40 percent of the world's population live in agricultural households. SLM is

very important for these people and a prerequisite for equity among those land users. Moreover, the livelihood of the farmers is improved if there is a better vegetation cover (greener) and better land. Therefore efforts, which lead to SLM, should be implemented on a local household level as well on a national and even international level. According to Mr. Sommer, Head of Division Natural Resources and Environment SDC, Bern, Switzerland, making the land greener in an overpopulated world may be the only realistic strategy to maintain the livelihood of poor, rural families. (WOCAT 2007)

The CDE (2008) sees the main concern of SLM not in preserving nature in a pristine state, but to coexist with nature in a sustainable manner. Sustainable manner means further to maintain the productive, physiological, cultural and ecological functions of natural resources for the benefit of society. To say it in a different way, SLM tries to harmonize the complementary but often conflicting goals of production and environmental protection" (CDE 2008).

Especially in developing countries, such as Indonesia, where food security is not ensured, this is a very important issue, and in order to survive, soil and other resources have to be charged. It seems to be important to recognize that first hunger has to be tackled in the present before the environmental protection for the future generation can be guaranteed.

Approaches

Approaches are defined by WOCAT as: "Ways and means of support that help introduce, implement, adapt and apply SWC technologies on the ground" (WOCAT 2007). WOCAT distinguishes three categories of approaches: Local initiatives (tradition), Local initiative (recent) and project/ programme based initiatives. If a SWC technology has spread spontaneously WOCAT defines it as a local initiative. This spread can occur recently or through many years, as a tradition always implies a transfer of knowledge within a community and through generations. On the other hand a SWC technology can be introduced by a project or programme. WOCAT believe that the analysis of the approach helps to understand how SWC technologies can be spread and where investments for the implementation of these technologies are most profitable.

SWC Technologies

Soil and **W**ater **C**onservation (SWC) technologies are defined by WOCAT as activities at a local level which maintain or enhance the productive capacity of the land in areas affected by, or prone to, degradation (WOCAT 2007). According to WOCAT, SWC technologies are defined as agronomic, vegetative, structural and /or management **measures** that prevent and control land degradation and enhance productivity in the field (WOCAT 2007). Looking at land degradation caused by human activities, the SWC technologies can be found everywhere in the world and can be described as good

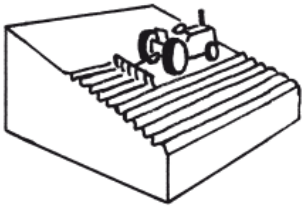
practices in agriculture. Further WOCAT distinguishes three **stages of intervention** of a technology: prevention, mitigation or rehabilitation. The stage of intervention determines the treatment of the degraded land and also, which technology or conservation measures should be used. **Prevention** implies a treatment or an application of a technology that maintains natural resources and their environmental and productive function on land that may be prone to degradation (WOCAT 2007). **Mitigation** means that the land already is degraded and that this on-going degradation has to be stopped, because the impacts of this stage are already noticeable in the short term. In this case strong incentives are provided. "The main aim here is to halt further degradation and to start improving resources and their functions. The last stage of intervention, **rehabilitation**, is required when the land is already degraded to such an extent that the original use is no longer possible and the land has become practically unproductive. In this case long-term and more costly investments are needed to have any impact" (WOCAT 2007).

WOCAT distinguishes nine **conservation technology groups** to cluster the SWC technologies found in the field. I used this typology for my thesis (see Table 2.1).

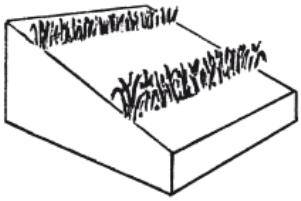
Name of the Group	Description
Conservation agriculture	systems incorporating minimum soil disturbance, a degree of permanent soil cover and crop rotation, ground cover improvement
Manuring/ Composting	to improve soil fertility, organic matter and enhance soil structure (against compaction and crusting) and improve water infiltration and percolation
Vegetative strips/ cover	strips often lead to the formation of bunds and terraces due to tillage erosion, in case of dispersed vegetation cover ground cover and infiltration increases and erosion by water and wind decreases
Agroforestry	trees are grown in association with agricultural crops, pastures or livestock and are both ecological and economic inactions between components of the systems
Water harvesting	collection and concentration of rainfall runoff
Gully control	whole range of different and complementary measures, though structural barriers dominate- often stabilised with permanent vegetation.
Terraces	wide variety: forward-sloping/ level/ backward-sloping terrace, with or without drainage system, irrigated terraces
Grazing land management	control and regulation of grazing pressure, initial reduction of the grazing intensity through fencing, rotational grazing or cut and carry
Other technologies	mixed bag of case study technologies

Table 2.1: Overview and description of the SWC technology groups. (WOCAT 2007).

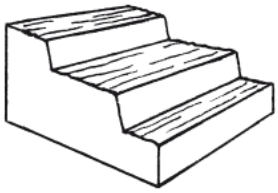
Further WOCAT defines four **conservation measures** and combinations of them, which are constituents of technologies. These four measures are listed and described in Figure 2.1.



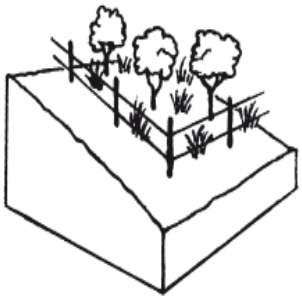
Agronomic measures such as conservation agriculture, manuring/ composting, mixed cropping, contour cultivation, mulching, etc
- are usually associated with annual crops
- are repeated routinely each season or in a rotational sequence
- are of short duration and not permanent
- are often not zoned
- do not lead to changes in slope profile
- are normally independent of slope



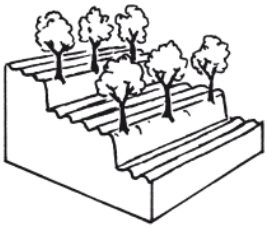
Vegetative measures such as grass strips, hedge barriers, windbreaks, or agroforestry, etc
- involve the use of perennial grasses, shrubs or trees
- are of long duration
- often lead to a change in slope profile
- are often aligned along the contour or against the wind
- are often spaced according to slope



Structural measures such as terraces, banks, bunds, constructions, palisades, etc
- often lead to a change in slope profile
- are of long duration or permanent
- are carried out primarily to control runoff, wind velocity and erosion
- often require substantial inputs of labour or money when first installed
- are often aligned along the contour or against the wind
- are often spaced according to slope
- involve major earth movements and/or construction with wood, stone, concrete, etc



Management measures such as land use change, area closure, rotational grazing, etc
- involve a fundamental change in land use
- involve no agronomic and structural measures
- often result in improved vegetative cover
- often reduce the intensity of use



Combinations in conditions where different measures are complementary and thus enhance each other's effectiveness.
Any combination of the above measures is possible, eg:
- **structural:** terrace
- **vegetative:** grass and trees
- **agronomic:** mulching
- **management:** fencing off

Figure 2.1: Conservation Measures by WOCAT (WOCAT 2007).

The classifications into technology groups and into different measures are sometimes overlapping and lead to confusion. The technology groups explained above are not conclusive, which is why the conservation measures are very useful and help simplify. The WOCAT categorization system of the different conservation measures is also very useful, because the technologies which are found in the field are often unique and have to be described for the first time.

2.1.3 Sustainable Livelihood (SLH) Framework, DFID

According to DFID (1999) the framework has been developed to help understand and analyse the livelihoods of the poor: "In essence it is a way of putting people at the centre of development, thereby increasing the effectiveness of development assistance" (DFID 1999). As a framework, it is a simplification of reality. This is one of the reasons the framework suits my research. The livelihoods in the research area are very complex and to bring structure into the flood of information the framework acted as a checklist in order not to forget the most important aspects for a livelihood characterization. See also KOLLMAIR and GAMPER (2002) mentioned later. Further DFID also mentions that a livelihood can only be understood by qualitative and participatory analysis at the local level.

The livelihood concept goes back to the work of Robert Chambers in the 1980s. Out of an on-going dialogue on how to achieve the goals and policy direction in the UK Government`s 1997 White Paper on International Development, the Guidance Sheet was developed. This guidance sheet provides the most information of this chapter. The aim of the Department of International Development (DFID) of the UK is to increase the sustainability of poor people`s livelihoods and the poverty elimination in poorer countries. "Sustainability is the key of the SLH approach because it implies a lasting progress in poverty reduction" (DFID 1999). The White Paper committed DFID to support policies and actions, which promote sustainable livelihood (DFID 1999).

According to DFID (1999) a livelihood is sustainable when it:

1. is resilient in the face of external shocks and stresses
2. is not dependent on external support
3. maintains the long- term productivity of natural resources
4. does not undermine the livelihood of, or compromise the LH options open to others

The core concepts of the Sustainable Livelihood (SLH) Framework are the following: people-centred, holistic, dynamic, building on strengths, macro- micro links and sustainability. I will not explain the concepts but would like to suggest the DFID guidance sheet on sustainable livelihood for further information.

DFID`s Theme Group, according to DFID (1999), should provide, among other things, an operational support to country programmes. One of WOCAT`s tasks is how to implement SWC technologies in a long-term perspective. The SWC technologies can be implemented if they are suitable and sustainable for the people's (or farmer's) livelihoods. The usage of the SLH Framework seems to be interesting for WOCAT because the livelihood analysis can help to increase the adoption and spread of SWC technologies. To understand how and why people implement a SWC technology in a long-

term perspective, is one of my main research questions and is also important for the long-term effects of the livelihood improvement programmes. This framework can also be defined as a bottom-up and multi-level-stakeholder development concept.

In Figure 2.2 the sustainable livelihood framework is presented. It consists of five main components: the vulnerability context, the livelihood assets, the transforming structures and processes, the livelihood strategies and the livelihood outcomes. It is important to address all the components to characterize livelihoods and not to forget any, considering that all the components depend on and influence each other. Only if all of the components are described, can we try to understand the whole system. This is why I tried to cover all the components in my research, albeit briefly, due to lack of time. Nevertheless I especially dealt with the first four categories. Through the purpose of DFID, poverty reduction, the **livelihood outcomes** are already defined. In context of this study and in terms of soil and water conservation the focus is set especially on the goal *more sustainable use of natural resources base*. Of course it has tried to link the implementation and sustainable use of resources with other positive livelihood outcomes. More income, increased well-being, reduced vulnerability and improved food security are other livelihood outcomes. It is also important that the households pursue sustainable use of their natural resources. Here the main difficulties are found in the very different livelihood outcomes of the various stakeholders. For example the farmers are looking to increase their outcome whereas the SWC specialists want to build more terraces to decrease soil degradation. Many SWC technologies however lead to smaller harvests in the short-term. A solution to such trade-offs would be governmental support of the farmers in the first years of initiating the SWC technologies.

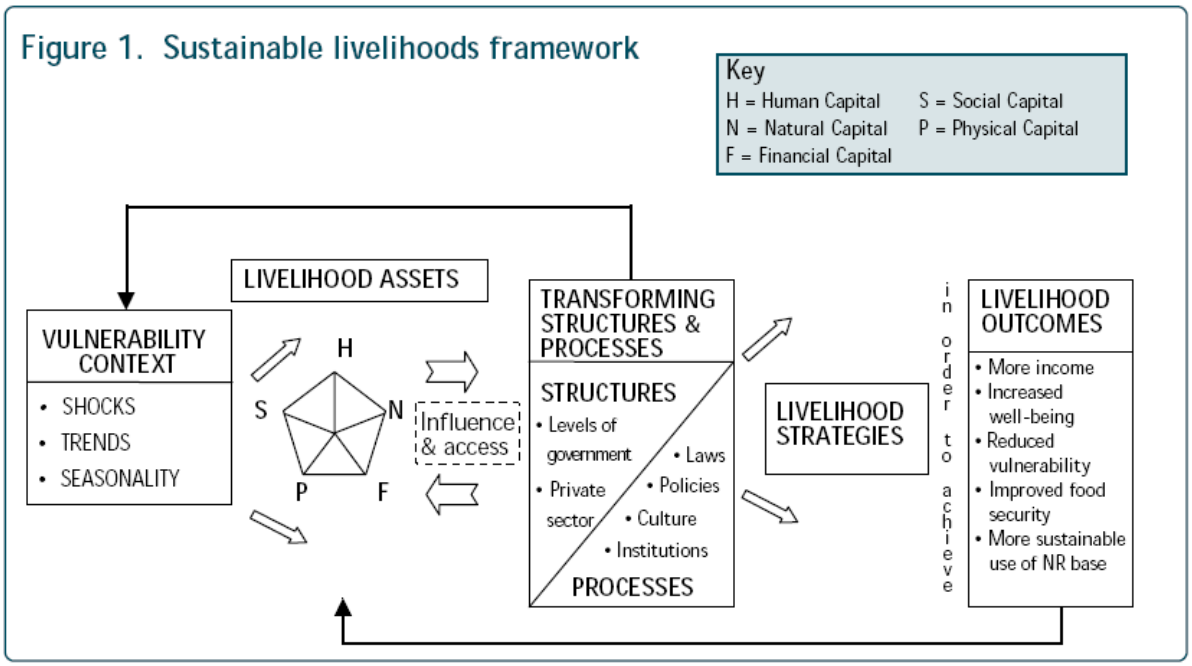


Figure 2.2: DFID Livelihood framework (DFID 1999).

The DFID **vulnerability context** is expressed by three different components: trends, shocks and seasonality and simultaneously presents the external environment. People living in this environment only have limited or no control at all over it. DFID sees the importance of these vulnerability factors in their direct impact upon people`s assets. Shocks like floods, storms, civil conflicts etc. can break down assets directly. Shifts in prices, employment opportunities and food availability are seasonal and a cause of danger for poor people in developing countries. Not all trends are negative and may be more or less benevolent. According to DFID (1999), the inherent fragility of poor people`s livelihoods makes them unable to cope with stresses, whether predictable or not. To manage the vulnerability context, DFID sees the way in helping people to become more resilient and better able to profit on its positive aspects. (DFID 1999)

The **livelihood assets** consist of five different capitals: human, social, natural, physical and financial capital (DFID 1999). These assets define the people`s strengths. Further the assets have to be converted into the livelihood outcome and are acquired through different livelihood strategies. The assets played an important role for my research, because they present the people`s starting position. According to DFID (1999) a single asset is not sufficient to achieve positive livelihood outcomes. There has to be a range of assets presented. DFID (1999) defines the five capitals as followed:

- Human capital: skills, knowledge, ability to labour and good health that together enable people to pursue different livelihood strategies and achieve their livelihood objectives.

- Social capital: networks and connectedness (vertical and horizontal), membership of more formalized groups and relationship of trust, reciprocity and exchange (informal safety nets among the poor). Social resources upon which people draw in pursuit of their livelihood objectives.

- Natural capital is the term used for the natural resource stocks from which resource flows and services useful for livelihood are derived.

- Physical capital comprises the basic infrastructure and producer goods needed (affordable transport, secure shelter and buildings, adequate water supply and sanitation, clean affordable energy and access to information).

- Financial capital denotes the financial resources that people use to achieve their livelihood objective. It includes flows as well as stocks and it can contribute to consumption as well as production. There are two main sources: the available stock (saving) and regular inflows of money (pension or other transfers from the state and remittance).

Transforming structures and processes are institutions, organizations, policies and legislation, which present frame conditions for livelihoods. They act on all levels, from the household to the international arena and in all spheres, in the most private and the most public. According to DFID (1999) they define the access, terms of exchange between different types of capitals and the returns to any given livelihood strategy and also influence whether people are able to achieve a feeling of inclusion and wellbeing. Because they are culturally set, they also describe, *the way things are done* within different societies. The structures are defined by DFID (1999) as: "the hardware- the organizations, both private and public- that set and implement policy and legislation, deliver services, purchase, trade and perform all manner of other functions that affect livelihoods." On the other hand processes are compared with software. "They determine the way in which structures- and individuals- operate and interact (policies, legislation, institutions, culture and power relations are just some of the transforming processes" (DFID 1999).

DFID defines the **livelihood strategies** as all the activities of a household to achieve the LH goals. Examples are productive activities or investments. Since goods, financial resources and people are all mobile it is important to place households and communities within their wider context (split families, seasonal or permanent migration of family members). Further DFID`s idea to assist poor people with their livelihood strategies is to generate an understanding of the indicators that define the people`s choice of livelihood strategies and then to reinforce the positive aspects and to minimize constraints or negative influences. Through choice, people will be provided with opportunities for self-determination and, over time to adopt the flexibility to achieve their livelihood goals. This, in turn, is

achieved through the improved access to assets of poor people and by reinforcing the structures and processes, which converse them into livelihood outcomes, DFID adds. The structures and processes should promote wider choice, reduce costs and extend access. (DFID 1999)

Strengths and Weaknesses of the Sustainable Livelihood Framework

First, this framework tries to illustrate reality and therefore is a simplification. The main challenge in developing a perfect and useful model of livelihoods is the fact that there are so many different factors and stakeholders influencing people`s decisions for livelihood strategies. In this section I will first present the main strengths and later, the main weaknesses of the framework.

Strengths: The framework can be adapted and used in different local settings due to its flexible design and openness to change. Further the concepts (people-centred, holistic, dynamic, building on strengths, macro-micro links and sustainability) of the framework can be seen directly as strengths, and the fact that the framework puts people and their strengths into the centre is to be emphasized. In many cases development programmes are made to solve problems. This framework however puts a positive light on the affected societies. The focus is set on the assets and not on the problem. Further, and important to mention, the framework aims to improve the lives of the poor through the sustainable use of natural resources. It seems to be better at identifying and supporting the local possibilities. According to KOLLMAIR AND GAMPER (2002) the SLF can serve as an analytical tool for the identification of development priorities and as a checklist, helping to bring some structure into ideas or developmental activities and not to forget the fundamental factors in the analysis of rural livelihoods. It also can assess how development activities match the local livelihoods of the poor (KOLLMAIR AND GAMPER 2002). This kind of checklist helped to analyse the different livelihood and to understand the important dynamics and changes in their room of action, by which they are influenced. Due to these arguments the framework seemed to be perfect to find out how SWC programmes and activities on a national, regional or local level should take place in a most effective, sustainable and long-term way, to combat soil degradation. As said before, this research tries to find out if livelihood factors influence the decision for or against the application of SWC technologies. A way to increase the attractivity for implementing SWC technologies lies in linking the usage of SWC technologies with other livelihood outcomes. With the help of the livelihood analysis the desirable and needed livelihood outcomes and how they are linked with other livelihood factors, can be defined. In this context I would like to mention the concept of the ISRIC`s Green Water Credit. “Green Water Credits (GWC) is a mechanism to transfer cash to rural people in return for water management activities that determine the supply of all fresh water at source - these activities are

presently unrecognized and un-rewarded. Direct payment will enable better management of the resource" (ISRIC 2011). Concerning the Citarum Watershed in which the upper zones provide fresh water and energy supply for the capital Jakarta and the lower regions, this would be a very interesting approach to promote SWC.

Weaknesses: According to KRÜGER (2003) a weakness of the framework is, that not all factors can be recorded by the five capitals. Also, personal events in life as well as good and bad luck have an effect on the livelihoods. This point seems to be very important because an accident for example can restrict a person`s possibilities to earn money needed to maintain a household. To avoid or to minimize this problem, the capitals and the strategies of the farmers were assessed by a personal interview. An additional point of critique, and similar to the critique of KRÜGER (2003), is that the sustainable livelihood framework is too structuralist. The model assumes that every family or other social group would react the same way with the same objective basic conditions and capital resources. According to WIESMANN (1998) this is not the case: First, the dynamic basic conditions are perceived and interpreted differently. Action is only taken after the subjective perception and interpretation of these conditions. Second, there is always a certain amount of room for personal choice, because the component of meaning, which stands behind actions, is influenced by socio-cultural values and norms but is not determined by them. And third, the decision making of a family to take a certain action is not just influenced by external conditions and capitals but also by inner, psycho-emotional affinities. (WIESMANN 1998). To minimize the effects of this critique, the personal interviews were also helpful. This way, the external conditions and capitals could be identified, as well as the socio- cultural values and norms, the interpretation and perception of the dynamic conditions and the inner psycho-emotional factors.

Weaknesses were also identified by BAUMANN AND HÖGGER (2004). They perceive the DFID framework as too simple because it merely considers the outer and not the inner realities of livelihoods. Based on this critique they developed an alternative heuristic tool, the *Rural Livelihood System Mandala*, for the Indian context. I will not explain this "tool" further, however information is easily obtainable.

More weak points of the livelihood framework are summarised in further references listed in PORTNER (2005):

- The definitions of capital, especially those of the social capital (see above) are vague (see FALK AND KILPATRICK 2000; GROOTAERT 1998; NARAYAN 2001, FOX 1997; THIN 2000).
- Power relations are not included in the framework (ADATO AND MEINZEN-DICK 2002).
- The capitals are not complete. BAUMANN (2000) added a political capital after conducting research in India;

- MACQUEEN (2001) argues that unless the assets are comparable, the sustainable livelihood approach is useless.
- An institutional analysis should also include the social structures of the community and family. It is not sufficient to investigate just the political structures and processes (governance) (BINGEN 2000; JOHNSON 1997; GOLDMAN 1999; HOBLEY 2001).
  JOHNSON 1997);
- The framework does not include socioeconomic, cultural, and historical aspects (DFID/FAO 2000; ADATO AND MEINZEN-DICK 2002).

2.2 State of the Art- SWC in Indonesia

In the frame of the WOCAT network there is a record of a SWC technology in Bali, Indonesia. It is the Paddy Field Terrace. This technology has been entered into the online database. Further there were other SWC technologies on the island Java recorded by the WOCAT questionnaires but they still have not been translated into English and are therefore not available on the Internet.

In the book '*where the land is greener'* published 2007 by WOCAT 42 case studies of SWC technologies are presented as well as the corresponding approaches. In total, they present 30 different approaches.

The Master thesis of JULIA TATIN (2005) should also be mentioned. The Government of Indonesia, specifically the 'Directorate of Watershed Management and Land Rehabilitation' of the Ministry of Forestry of Indonesia, decided to join WOCAT and to implement it in 2001. TATIN assessed the WOCAT methodology after its implementation 4 years ago. According to this study the methodology is underused. In 2005 only 8 provinces were involved in this process - due to lack of funding, she adds. The main constraints to the use of WOCAT include lack of: specific funds, time and staff, access to the internet and organization and cooperation between each level of decision-making.

There exist quite a lot of studies and reports about SWC technologies in Indonesia but unfortunately they are all written in Indonesian and could therefore not be understood. A very interesting paper concerning soil and water conservation is called 'A sustainable upland farming system for Indonesia' written by J.SRIADININGSIH AND A. SYARIFUDDINKARAMA (1992) of the Centre for Soil and Agroclimate Research (CSAR) in Indonesia. It discusses the agricultural development of the sloping lands in Indonesia, especially on the island Java. Because of major erosion and water shortage, low soil fertility and productivity, and lack of sufficient production factors such as good seeds and credit in the upland, they suggest an appropriate integrated farming system as a solution. This specific integrated farming system consists of five different components: tree crops, food and forage crops, livestock, management of organic matter and fisheries. Besides the biophysical investigations and aspects, the paper also integrates a socio- economic analysis.

3 Methodology and Methods

3.1 Selection of the Study Area

This research was undertaken with the cooperation of the Ministry of Forestry of Indonesia based in Jakarta. At present Indonesia is in the process of becoming a WOCAT partner. This study is a pilot study to assess the interest and willingness of Indonesia to become a partner and to obtain information about SWC technologies in the sub humid to humid zone. According to MR. SYAIFUL ANWAR, Ministry of Forestry of Indonesia (2010) in Indonesia and especially in Java there is an increasing pressure on natural resources, especially on the rainforests. The intensification of agricultural land and the deforestation, changes the ecological cycle and leads to natural catastrophes like landslides, soil degradation, erosion and floods.

The Citarum Watershed, and the rivers arising from it, was chosen for its role as main water source for drinking water and energy for the capital city of Jakarta and, its therefore important role for the island.

Further the Upper Citarum Watershed was chosen because of the steepness of the slopes contributing to soil erosion. In this area there are primary and secondary forests and untouched natural resources. This region is a place where agriculture and nature collide. The rainforest, along with its natural resources, which include biodiversity, finds itself under high pressure by the growing population. The Upper Citarum Watershed was also chosen because the local agricultural use has a strong effect on the land downhill and over all on the Saguling Reservoir due to sedimentation entailed by cultivation. This reservoir, due to it delivering hydropower pf 700 MW (ILEC 2011), is very important for Jakarta.

Since the Upper Citarum Watershed would have surpassed the scope of a single study of this kind, the Sub Watershed Ciwidey was chosen. This sub watershed displays a high variability and diversity of the different land use systems.

3.2 Selection of the Sample and Planning

No detailed information on the population and the land use technologies of the individual households was known prior to this study. For an optimized data collection to answer the research questions, typical households for each land use system needed to be found. First I selected the relevant **L**and **U**se **S**ystems (LUS) for my research out of the different LUSs identified by Cinzia De Maddalena and myself. In Table 3.1 the LUSs pertinent for this study are presented and described.

The most relevant LUSs for this research are: *cut and carry with farming, bushland with farming, farming lowland, tea plantation* and *agroforestry*. The LUS of *irrigated rice* is not taken into account because there were no soil degradation problems detected in this field. Irrigated rice is planted at lower elevation on gentle slopes. Therefore it has been determined to being of no interest for the this study. The rainfed rice was not planted during my field stay because it was the dry season. In the dry season farmers use the terraces in higher altitudes to plant vegetables (multifunctionality). Furthermore, the area of the LUS *upland farming* is very small and remote and is therefore also not integrated into my study. Although the LUS *tea plantation* doesn't display much soil degradation, it is discussed anyway because of its permanent vegetation and its importance for this region. Additionally the fields are situated in higher altitudes, which are landslide prone. In each of these LUSs, two households with adoption of SWC technology and two households' whiteout the adoption of SWC technologies should be visited and interviewed. By this selection the different LUS could be examined in terms of the research question: why they adopted SWC technologies or not and how the different reasons for the adoption varied between the different livelihoods in the different LUS. Whether the different households adopted SWC technologies or not will have been ascertained by the extension workers of the local government Bandung. The households were also chosen by the remoteness, the accessibility and the willingness of cooperation of the households. To get the same situational condition, households with agricultural land with a steepness of more than 20 degrees were selected.

Due to the problems mentioned in the Chapter 3.3.1, the sample was different. At the end I had 20 interviews which represented twenty case studies: four farmers situated in the LUS *cut and carry with farming*, five in the LUS *bushland with farming*, five in the LUS *farming lowland*, four in the LUS *agroforestry* and two in the LUS *tea plantation*.

LUS ID	*Land Use System Class*	*Class Description*
1	**Cut and carry with farming**	*Cut and Carry* are all areas that cover grassland for fodder production and farming plots. The small-scale farmers possess livestock such as goats, chickens or cows. Therefore the fodder grass is planted in the plots or on the edge of them. Besides grass production, cutting and carrying, farmers cultivate mixed vegetables (beans and corn, tomatoes and chilly) for self-subsistence. This farming system is extremely labour-intensive and has a sparse tree and shrub cover.
2	**Bush with farming**	*Bush with farming* are all areas, situated on hills or ridges. They are unstructured and inappropriately managed. There are many kinds of crops such as tomatoes, chillies, beans, maize, cabbage, potatoes, cassava and fruit trees such as banana and papaya. Crops and fruit trees are spatially mixed with shrubs and endemic trees. Most of this land belongs to wealthy people from Jakarta they do not care about their production system and environment, causing high land degradation.
3	**Farming lowland**	*Lowland farming* is a land use system in a plain or valley, which has enough humidity or stream flow usable for irrigation. The plots either are irrigated or rainfed, depending on the crop species and its need of humidity. In general, annual species such as onion leaves, tomatoes, carrots, potatoes, and cabbage are commonly cultivated. The scale varies from small-scale subsidence oriented to large-scale market oriented farmers. Vegetables are planted as a monoculture system. Within this category, chemical fertilizer is intensively used, contrary to organic fertilizer, which is rarely used. The farming plots are either divided by soil bunds or in stepper regions, by stone terraces.
4	**Agroforestry**	*Agroforestry* is a forest, which has re-grown both with and without human activities (regreening, planting trees) after a major disturbance such as fire or logging. It is still intensively used for small-scale farming activities but not for timber harvesting. There are several small-scale farming plots in the forest and at the edge of the forest. The farmers apply agroforestry systems with pine/eucalyptus and coffee, or production commodities such as bananas, cassavas, tomatoes, chillies, potatoes and beans. In this kind of secondary forest soil erosion rate is very high. One part of this forest area is managed by Perhum Perhutani. The other very intensively cultivated part belongs to the local communities and is labelled community forest.
5	**Tea plantation**	All areas of systematically planted, non-timer based plantations such as tea and quinine. This land use system includes both young and mature plantations that have been established for commercial non-timber production. The plantations are always monocultures and are producing crops to sell in national and international markets. Tea plantation is a specific type of farming economy. Most of these plantations are owned by a large landowner that employs a number of tea pickers carrying out the work.

3.1: Overview and description of the Land Use Systems (LUSs) relevant for the present study. (CINZIA DE MADDALENA 2011).

3.3 Data collection

To collect the data in the field the method of the interview was chosen. According to DIEKMANN (2007) it is an open or semi-structured personal interview, which is carried out 'face to face'. The answer categories were not given and no fixed order was chosen. The procedure of the interview was defined by the sequence of the questions. The semi-structured form was chosen because this paper is meant to be a pilot study and previous knowledge was limited, therefore the answers given had to be more divers and open. "Die Konstruktion standardisierter Interviews ist nur dann zweckmäßig, wenn ein erhebliches Vorwissen über die zu erforschende soziale Situation existiert" (DIEKMANN 2007). Further the perspective of the subject and its significance was of interest. "Kritisiert wird, dass soziale Phänomene, die außerhalb des Fragerasters und der vorgegebenen Antwortkategorien liegen, die standardisierten Interviews aus dem Blickfeld der Forschung ausgeblendet werden."(DIEKMANN 2007), This is important in order to understand a typical livelihood system like this one. The 'qualitative' guided interview contains a series of thematic aspects, which are asked in the course of the interview. The questions are open and the order is not given at the beginning. The guideline of the questions is composed of a combination of semi-structured SWC technologies questionnaires by WOCAT and sustainable livelihood approach framework by DFID.

To collect the different approaches, gather more information and to control the answers of the farmers about the SWC technologies, expert interviews were held to obtain more specific and specialized information. Experts represented staff of the University of Agriculture in Bogor, contact persons and representatives of the Ministry of Forestry of Indonesia and the local government of Bandung. With this additional information source it was possible to compare, complement and verify the more subjective answers of the farmers. As additional information source, literature was used to complete the description of the SWC technologies and to fill out the template WOCAT 'light'.

Further, observation was used as a method in the study. According to definitions by DIEKMANN (2007) my observations were participating, open, unstructured, externally-observed and to be held in the field. Passive participation was given, due to my defined role as a foreign student and visitor in the social field (KÖNIG 1973 in DIEKMANN 2007). To document the reality and my observations I also used the means of photography. This method was very important, successful and suitable as I could record observations and discusses them later with experts, even in Switzerland. Before the interviews were held, I visited the whole field accompanied by the farmer in question, extension workers and my translator to get an overview of the SWC technologies in the area and the products cultivated. After or during the visit of the farmers the coordinates of the farms were determined by GPS.

3.3.1 Problems of the Data Collection and Lessons Learnt

Unfortunately the samples could not been covered as planned. Over time I realized that every farmer in the research area has his own SWC technologies. So the category 'non-adoption' did not exist. The second problem was, that the farmers chosen by the extension workers often did not fit my selection categories, the farmers were sometimes chosen by personal contact or friendship with the extension worker. Another problem was the attendance of the extension workers as a representative of the state. In the beginning they always wanted to answer the question for the farmer and the farmers were also intimidated and could not speak freely out of fear or inhibition (social desirability). Especially the farmers in the secondary forest often did not want to answer questions about their relationship to the state-owned enterprise, who is managing the forest resources in the island of Java and Madura in the form of Public Corporation (Perhum Perhutani) and seemed to be mistrustful and anxious to me. This was maybe also due to the presence of the extension worker. To avoid this problem and in order to reduce the pressure resulting from the social desirability, the extension workers no longer attended after some test interviews. Some areas could not be visited because of bad road conditions and the remoteness of the farms.

Another problem was to categorize the farmers into one specific LUS, because the majority of the farmers have fields in different LUS. Finally the LUS was defined by the location of the farm.

The openness of the questions, the huge variety of given answers, the subjectivity of the interviews and the small sample were the main problems of the data quality. According to DIEKMANN (2007) the chosen procedure of a semi-structured guided interview depends on the interviewer's knowledge and interpretation (of answers and mimic) or even on his social sensitivity to social phenomena (procedure objectivity) (DIEKMANN 2007). Further, DIEKMANN (2007), even sees the manner of formulating questions as factor, which strongly affects the reaction the answers.

Because of the language barrier, I was always accompanied by a translator. My questions were first translated from English to Indonesian. As a result the questions were first interpreted by the translator and then by the interview partner, which causes several problems regarding the accuracy of the questions. The same has to be said about the answers, which were first interpreted by the translator and then by myself. Therefore the information is strongly filtered. The objectivity as an important demand was affected. Due to the translation the duration of a farm visit lasted for a long time, between three and four hours. Such long visits require a high willingness and interest of the farmers. In some cases the farmers asked for a reward.

Originally the standardized WOCAT questionnaire to document SWC technologies should have been filled out in a workshop held in Ciwidey. 15 extension workers, Memet (the key farmer and NGO holder) and two members of the local government of Bandung attended the workshop. The

workshop was a failure and the filling out of the questionnaire had to be cancelled because it took too much time due to the translation problems.

The time of the visit led to further complications since it fell into the period of Ramadan. Because of the fasting, the farmers were no longer able to concentrate after 2 pm. Unfortunately, due to this problem it was not possible to interview the number of farmers determined at the beginning. Additionally, the work with the translator was very hard and exhausting because of the fasting. Even the work with the extension workers was complicated. At the end the collaboration had to be discontinued due to several problems. Especially this caused severe problems, as it was very difficult to orient oneself without any map or local expert.

A categorization of SWC technologies was hard to conceive due to high variation of used technologies.

The district of Bogor manages the Upper Citarum Watershed although the watershed is in the district of Bandung; this fact had a negative effect on our work because the information about the watershed and the responsible persons were far away and the visits were very time-intensive.

3.4 Data Analysis

The raised empiric data was analysed qualitatively. The given answers were structured thematically and coded and listed into Excel tables and diagrams for a better overview and interpretation. First the 20 interviews were inserted into a Word document and the photographs and drawings were attributed to the corresponding farmer. During digitalization, the data was also verified. Then the information about the different SWC technologies was put together and described in the standardized template sheet of the WOCAT for SWC technology documentations. If there was not enough information available out of the interviews, supplements using literature were made. If not enough information about a technology could be found; only the first page of the template was filled out. Afterwards the different SWC technologies were listed into an Excel sheet and each farmer was listed with the technology he employed on his farm. The result was a matrix table. Then the information about the different approaches were gathered and also listed in an Excel sheet. Further, the possible reasons for the adoption of the SWC technologies were assembled and listed for each farmer in an Excel sheet. Here the information on age, farm size or household size was taken over in the tables. So the data was listed in tabular form and afterwards its distribution was outlined graphically. Averages and medians were calculated wherever possible and illustrated in bar charts. At the end, correlations have been figured out by using the Pearsons correlation coefficient.

The evaluation and validation of the questions and hypotheses relay on the data collected in the interviews and out of secondary literature.

4 Results and Interpretation

In this chapter of the study the results derived from the field work and data analysis are discussed and interpreted with the help of my research questions.

4.1 Which SWC Technologies Are Used in the Research Area?

4.1.1 The Different Soil and Water Conservation Technologies

In the study area a great diversity of Soil and Water Conservation (SWC) technologies was found. According to WOCAT (2007) they can be categorized into different groups: terraces, gully control, water harvesting, conservation agriculture, agroforestry, manuring/composting, vegetation strips/cover and others. These technologies can also be grouped into three different measures: agronomic (A1, A2), structural (S1, S4, S5, S6) and vegetative (V1, V2) measures including combinations. Table 4.1 gives an overview of the 14 different SWC technologies found in the field and the categorization into the groups and measures according to WOCAT. The 14 SWC technologies cover all the 8 groups. In the following section I will use the English terminology for a better understanding but to complete also the Indonesian names of the SWC technologies are listed in Table 4.1.

WOCAT groups	WOCAT Measures	Conservation Technology, local names, Ciwidey	Conservation Technology, english names
Terraces	**S1,V2**	Teras bangku	Level bench terrace
	S1,V2	Teras kredit	Forward sloping terrace
	S1,V1/2	Teras petak	Narrow forward sloping terrace
	S1,V2	Teras benteng lahan	Irrigated level bench terrace
Gully control	**S6,S5**	Rorak/ lubang buta	Sediment trap
	V1	Bamboo	Bamboo, tree plantation
Water harvesting	**S4**	SPA	Drainage canals
Conservation agriculture	**A1,V1/2**		Permanent Veg. Cover
	A1,A2		Crop rotation
Agroforestry	**V1**	Tumbang sari	Agroforestry
Manuring/composting	**A2, (A1)**		Compost/organic fertilizer
Vegetation Strips/cover	**V1**		Tree plantation
Others	**A1**		Pastic cover
			Natural predators

Table 4.1: An overview of the different SWC technologies in Indonesian and English, as well as the categorization into the WOCAT groups and measures. A: agronomic measures, S: structural measures, V: vegetative measures (WOCAT 2007 and own compilation)

In a separate document the different SWC technologies are described extensively. For a coherent description the WOCAT template 'light' was used. To fill out the template the information from the interviews was used and, where required complemented by literature. In this case the information source is cited directly in the text. Where the information was limited, only the first page of the template was filled out. The use of the WOCAT template allows a practical and uniform overview of the technologies and facilitates the comparison.

First the individual samples (farmers) were categorized into the land use systems (LUS) defined by Cinzia De Maddalena. Four farmers depend on the LUS *cut and carry with farming* (LUS ID 1), five on the LUS *bushland with farming* (LUS ID 2), five on the LUS *farming lowland* (LUS ID 3), four on the LUS *agroforestry* (LUS ID 4) and just two on the LUS *tea plantation* (LUS ID 5). A first result is that every farmer uses at least one SWC technology. The range of SWC technologies used by a farmer lies between one (in the LUS *tea plantation*) and seven (in the LUS *bushland with farming*) different technologies (Figure 4.1). Table 4.2 gives an overview of which SWC technologies are used by how many farmers in the different LUSs and how often. In the first row the WOCAT groups are presented, followed by the WOCAT measures in the second row. In the third row the technologies are listed. The different colours represent the different LUS. In the last row and column, the respective totals are presented. Figure 4.2 shows how many farmers have in total the respective SWC technology used and in Figure 4.3 the totals of applications of the technologies are summarized into the WOCAT groups. Altogether 71 uses of SWC technologies were found within the 20 sample farmers. It is very important to mention that these results refer to the twenty interviews and farm visits in the scope of this research. For this reason and due to the pilot study character of this research it is important to talk about case studies. To be able to generalize these findings, more extensive research should be done, involving a substantially larger number of farmers.

SWC Technologies

	Groups:	Terraces				Gully Control		Water Harvesting	Conservation agriculutre		Agro-forestry	Manuring/Compost-ing	Veg. Strips/ cover	Others		TOTAL:
	Measures:	**S1, V2**	**S1,V2**	**S1,V1/2**	**S1,V2**	**S6,S5**	**V1**	**S4**	**A1,V1/2**	**A1,A2**	**V1**	**A2, (A1)**	**V1**	**A1**	**-**	
LUS ID	Farmer ID:	Level bench terrace	Forward sloping terrace	Narrow forward sloping t.	Irrigated level bench t.	Sediment trap	Bamboo	Drainage channels	Perm. Veg. cover	Crop rotation	Agroforestry	Compost / Organic fertilizer	Tree plantation	Plastic cover	Natural predators	
1	1*	1				1		1	1	1						5
	2*		1							1						2
	3		1						1		1					3
	15	1				1		1	1	1						5
2	4	1					1	1	1		1	1	1			7
	6	1	1				1		1			1	1	1		7
	9		1						1	1			1			4
	10	1							1	1						3
	20			1			1		1		1		1			5
3	7	1							1	1			1			4
	8	1											1			2
	17				1			1		1						3
	18											1				1
	19				1			1								2
4	5	1				1			1		1	1				5
	11								1		1	1				3
	12		1									1	1			3
	16		1									1			1	3
5	13								1				1		1	3
	14												1			1
	TOTAL:	**8**	**6**	**1**	**2**	**3**	**3**	**5**	**12**	**7**	**5**	**7**	**9**	**1**	**2**	

Table 4.2: Overview table of SWC technologies found in the farmers field. In the first column the Land Use Systems (LUS ID) are listed: 1: *cut and carry with farming*, 2: *bushland with farming*, 3: *farming lowland*, 4: *agroforestry*, 5: *tea plantation*. Farmers marked up with '*' have a considerable portion of the fields in another LUS called *upland farming*. t.: *terrace*, Perm.: Permanent Veg.: Vegetation: The used WOCAT measures are: S1: structural bench terraces, S4: structural graded ditches/waterways, S6: structural dams/pans to store excessive water, A1: agronomic vegetation/soil cover, A2: agronomic organic matter/soil fertility, V1: vegetative tree and shrub cover, V2: vegetative grasses and perennial herbaceous plants.

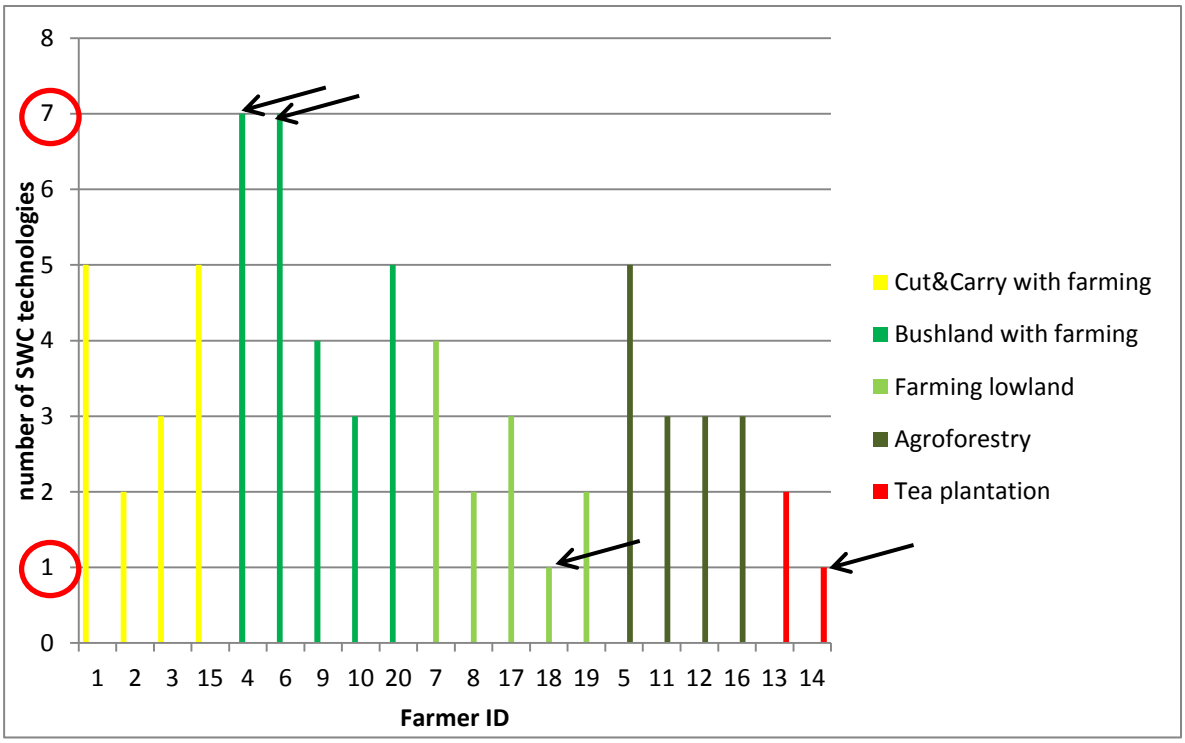


Figure 4.1: The amount of SWC technologies in the fields mentioned by the farmers. The farmers are grouped by the LUSs.

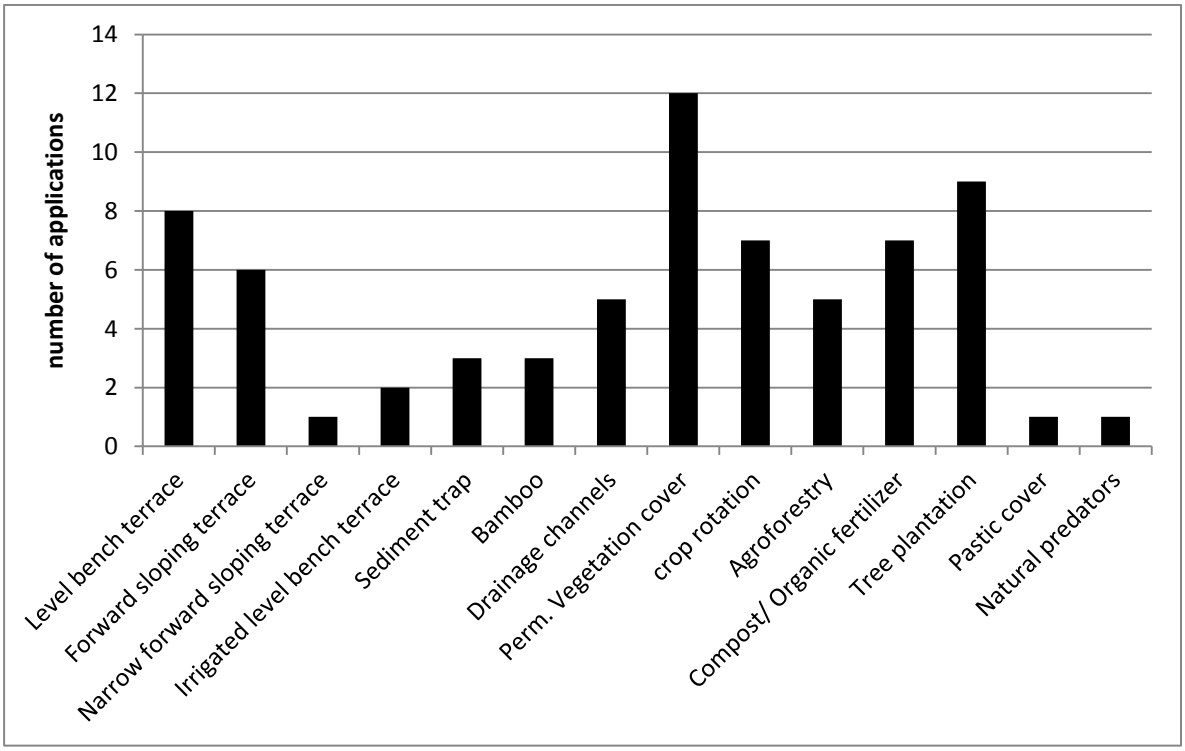


Figure 4.2: The different SWC technologies and number of their application. The data is based on the interviews and field visits. It represents the under most row of Table 4.2. Multiple response, n=20.

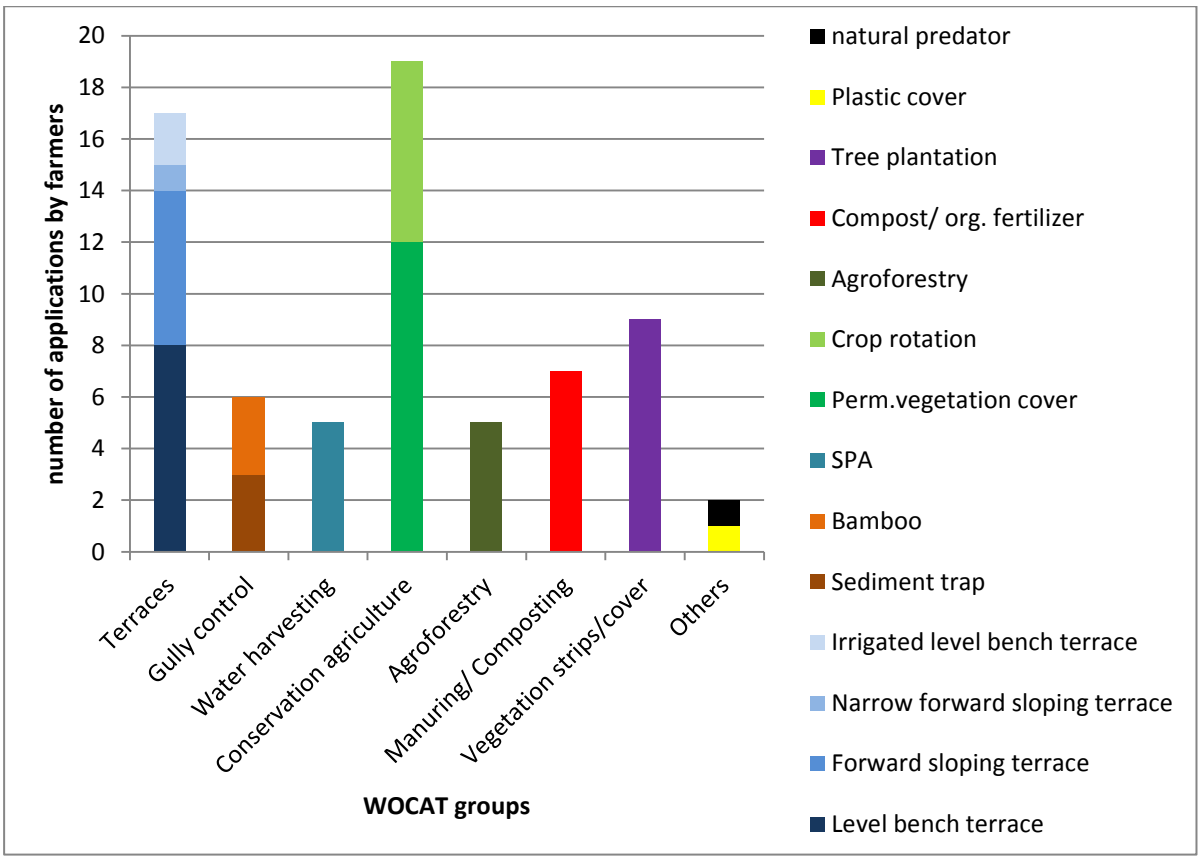


Figure 4.3: The number of applications of the technologies by farmers. The technologies are summarized into the WOCAT groups but still are apparent by different colours.

4.1.2 SWC Technologies Spread

The most frequently used SWC technology of the sample is *permanent vegetation*, 60 percent or twelve small scale farmers use this technology. It is the only technology used by more than 50 percent of the observed farmers. The second and third most frequent technology is *tree plantation* (used by 45 percent of the farmers) and *level bench terrace (terrace bangku*) (used by 40 percent of the farmers) (Figure 4.2). The first two are vegetative measures, the third a structural measure. Looking at the terrace technology group *level bench terrace* and *forward sloping terrace (terrace kredit*) are the most applied terraces followed by the other two. The *level bench terrace* is used by eight farmers, *forward sloping terrace* by six farmers. All of the terraces also include a vegetative measure. The technologies *narrow forward sloping terrace (terrace petak), plastic cover* and *natural predators* are mentioned just once. We can say 16 farmers have at least one terraces of any kind, 14 farmers apply *conservation agriculture* (permanent vegetation cover or/and crop rotation) and six farmers practice *gully control* (see Table 4.2).

4.1.3 Distribution and Combination of SWC Technologies in the Land Use Systems

In the following, the main characteristics and patterns of the technologies used will be presented for each land use system. The description of the presence and combination of SWC technologies by the LUS was chosen, because researchers would expect the farmers to choose the applied technologies due to similar land conditions or even products.

LUS Cut and Carry with Farming

In this land use system, seven different SWC technologies were found on four farms. The ones most used are the *permanent vegetation cover* and the *crop rotation*. Both belong to the WOCAT group of conservation agriculture. *Level bench* and *forward sloping terrace* are mentioned twice (two of four farmers). In this LUS there is no other kind of terrace used. (Because the *irrigated level bench terrace (terrace bentang lahan)* is only used in the LUS *farming lowland* and the *narrow forward sloping terrace* was found in one field with very humid soil). Also *the sediment trap (rorak or lubang buta)* and *drainage channels (SPA)* are used by two out of four farmers and the *agroforestry (tumbang sari)* technology is listed once. The range of the number of used technologies lies between two to five. The practice of planting *bamboo* to control gullies was not mentioned by the farmers but was observed. *Manuring/ composting* and *vegetative strips/ cover* were not used in this LUS due to the arid conditions. However it would be very useful to plant trees and other plants to stabilize the soil and ameliorate the soil structure to combat soil erosion also including the secondary effect of a better water storage in this, more arid area.

LUS Bushland with Farming

In this LUS eleven different SWC technologies are being used on five farms. *Permanent vegetation cover* is used by every farmer and *tree plantation* is used by 80 percent (four of five farmers). Both of these technologies are vegetative measures, whereas the *permanent vegetation* cover also contains an agronomic measure. The next frequent technologies are the use of *bamboo* as gully control, also a vegetative measure, and the *level bench terrace* that combines a structural and vegetative measure. Further technologies mentioned used by less than half of the interviewed farmers are *the forward sloping terrace, crop rotation, or agroforestry, composting/ organic fertilizer*. The *narrow forward sloping terrace, drainage channels* and *plastic cover* are mentioned by just one farmer. The number of used technologies ranges between three and seven. Two farmers use seven different technologies and no farmer uses less than three. In this land use system, the highest amount of different

technologies is to be found. I suppose that this fact results from the microclimate in this area since, contrary to the LUS *farming lowland* there is more vegetation. So *tree plantation* as well *compost/ organic fertilizer* can be used as technologies. On the other hand in this LUS we still find relatively steep slopes and therefore the terraces are also of interest.

LUS Farming Lowland

In this LUS seven different SWC technologies are found on five farms. A technology that is used by the majority of the farmers does not exist. Five technologies are mentioned twice, i.e. by less than the half of the farmers in this LUS: the *level bench terrace, irrigated level bench terrace, drainage channels, crop rotation* and *tree plantation*. The *irrigated level bench terrace* was only found in this LUS, in an area that is flatter than the upper zone and where irrigation channels are important. *Permanent vegetation cover* and the *compost/ organic fertilizer* technologies were found on just one farm. In this LUS most farmers are market oriented and want to sell their products, they often rely on short-term profit. Here we also find intensive agriculture; vegetables are the most planted products. Vegetables like cabbage and onion leaves are harvested and often have no plant residues. Due to this, the farmers have to use more fertilizer to maintain the soil fertility which is also the reason why just one farmer used the technology *compost/ organic fertilizer*. To stabilize the terraces, to increase the soil moisture and to support the soil fertility due to the fallen leaves, trees are planted. Further, the farmers told me that they plant very high trees in order not to decrease the solar exposition of the vegetables. They plant trees like the `*durian*` tree *(durio zibethinus)* or `*petai*` tree *(parkia speciosa)*. To maintain the soil fertility the technology *crop rotation* is very important here, but was mentioned by only two farmers. *Crop rotation* seems to be a suitable method for this LUS. The number of different technologies per farmer is lower compared to the other LUS but at least one technology is found on every farm and one farmer had up to four different technologies.

LUS Agroforestry

In the secondary forest all of the five farmers, use *compost/ organic fertilizer*, which seems natural. Altogether eight different SWC technologies are found in this LUS. *Forward sloping terrace, permanent vegetation cover* and *agroforestry* are mentioned by half of the farmers. SWC technologies like the *level bench terrace*, the *sediment trap*, the *tree plantation* and the use of *natural predators* against pests are listed once. Where the slopes are steep, the farmers stabilize them with *the level bench* or *forward sloping terraces* depending on the financial capital, whereas implementing *level bench terraces* is more expensive. The use of the technologies *agroforestry, permanent vegetation cover* and *tree plantation* are integrated naturally in this LUS. Here *natural predators* are used, especially to protect the coffee plants. The number of technologies ranges between three and five technologies. No farmer uses less than three different technologies.

LUS Tea Plantation

In the tea plantation only three different technologies can be found on two farms: the *permanent vegetation cover, tree plantation* and *natural predators*. The *permanent vegetation cover* is naturally ensured by the tea shrubs, only the leaves are harvested and the shrubs remain untouched. Because the soils are not disturbed, the erosion in this LUS is usually very small. Where the slopes are steep, high trees like *durian, petai* or Eukalyptus are planted between the tea shrubs for stabilization. One farmer had three technologies and the other tea farmer had just one. For further SWC technologies in this LUS the Research Centre of the State Tea Plantation (PTPN 8) may be consulted

4.1.4 Concluding Remarks

In the following the key findings are presented. First looking at the commonalities of the LUS' and then looking at the different SWC technologies. In the research area we find a very largely conserved landscape. All the farmers have at least one SWC technology and most have more, some up to seven. This is also the reason why the sample could not be divided into the two groups 'adoption' and 'non-adoption'. Most notably in the LUS *cut and carry with farming* and *bushland with farming* the WOCAT group conservation agriculture and the technology *permanent vegetation cover* is evident. *Bushland with farming* is the LUS with the highest number of different SWC technologies combined; there are farmers with up to seven technologies. Furthermore, in the LUS *agroforestry* every farmer has the technology *composting/ organic fertilizer*. The *permanent vegetation cover* technology is found in all LUS.

In the fields of the tea farmers no ***terraces*** could be found. Further in the LUS *cut and carry with farming, bushland with farming* and *agroforestry* there are two forms of terraces: *level bench and forward sloping terraces*, whereas in the LUS *farming lowland* only the *level bench terrace* is used. According to the interviews these two terraces are often found together on the same land. Only three forms of terraces are found in the LUS *bushland with farming*; the farmers in the LUS *agroforestry, farming lowland and cut and carry with farming* have two forms. The *irrigated level bench terrace* is only found in the LUS *farming lowland*. In the LUS *cut and carry with farming* and *the bushland with farming* every farmer has terraces; in the LUS *agroforestry* three out of four farmers have terraces. The narrow *forward sloping terrace* is found in the LUS *bushland with farming* and the *irrigated level bench terrace* is only employed in the LUS *lowland with farming.*

The technology ***tree plantation*** is represented in every LUS except in the LUS *cut and carry with farming*; the reason for this could be the dry circumstances of the area. Farmers want to use the existing water for their production. Another reason could be the poverty of the farmers; they do not have enough money to buy seedlings. Also the steep slope can be a hindrance for trees to grow. ***Sediment traps*** are only found in the LUS *cut and carry with farming* and *agroforestry*. Here water can be stored; this is because slopes in the upper zone (LUS *cut and carry with faring and agroforestry* are included) are relatively steep and the water has to be stopped. Also, collecting water is important in the dry area in the LUS *cut and carry with farming*. Further the technology ***bamboo*** is only present in the LUS *bushland with farming*. Due to the fact that this LUS is situated directly after the uppermost mountainous zone and the runoff reaches its most disturbing energy and speed, it is assumed that in this LUS the highest number of gullies can be found. Additionally due the good soil moisture, bamboo is flourishing very well. Because the ***drainage channels*** are simply found in food crop locations (and are often combined with terraces); this technology is neither found in the *tea plantation* nor in the *agroforestry* LUS. It is obvious that the farmers with the technology ***crop rotation*** plant food crops and therefore this technology is found in the LUS *cut and carry with farming, bushland with farming* and the *farming lowland*. The ***agroforestry*** as a technology is found in the LUS *bushland with farming* and *cut and carry with farming.* In the LUS *farming lowland, agroforestry* is absent. There is no ***composting/ organic fertilizer*** technology in the LUS *cut and carry with farming,* nor in the LUS *tea plantation.* The reasons why there is no *compost/ organic fertilizer* in these two LUSs are different. In the LUS *cut and carry with farming* it can be explained by the small amount of vegetation and in the LUS *tea plantation* because here the soil is not processed and the shrubs are left standing there. The ***natural predators*** are used in the LUS *agroforestry,* in the coffee plantations, and in the *tea plantation*. The technology *plastic cover* is only found in the LUS *bushland with farming*.

4.2 Which Approaches are used for Implementation?

4.2.1 Approaches in the Fields

Many different approaches and information sources were mentioned in the farmer and expert interviews. Approaches according to WOCAT (see Chapter 2.1.2.2) are defined very confusingly and are often understood in terms of a project or programme. In my research I will almost always use the term information source, based on the question from where the farmers have the information about SWC technologies. In Table 4.3 the different information sources first are classified according to the WOCAT approach categories or how the information was generated: local initiative (tradition), local initiative (recent) and project/ programme based approaches. These approaches were further refined into my own categorization. The purpose of my own categorization is to refine and deepen the WOCAT categorization and to obtain a categorization suitable for the data found in the field. My own compiled categorization system is based on the degree of social and spatial distance between the information source and the individual as well as the nature of interaction between the individuals while changing or passing information. In the following section the five categories of my own categorization basis-*family/culture, near environment, government, education and media* are described and discussed in the focus of the LUS and their spread. Table 4.3 gives an overview of the 44 answers of information sources by the different farmers. In the category *government*, besides different information sources, approaches according to the definition of WOCAT 2007 could be recognized.

The project/ programme and the local initiatives (tradition) approaches of the WOCAT categorization are the most frequent and important ones in this region, according to the farmers' answers. Fourteen farmers were familiar with the information sources of the WOCAT category 'project/ programme based approaches', nine farmers mentioned information sources of the WOCAT category 'local initiative (tradition)' and five farmers mentioned information sources of the WOCAT category 'local initiative (recent)'.

Beside the information sources mentioned in the personal interviews of my sample, further approaches and initiatives have been worked out in expert interviews and a workshop. These information sources generated out of the expert interviews are also included in Table 4.3. These approaches and information sources are described in Box 4.4 more detailed.

Approaches and Information Sources

	WOCAT	Local Initiative (Tradition)	Local Initiative (Recent)		Project/ Programme Based Initiative										TOTAL:
	Distance to Individual	1. Family/Culture	2. Near Environment		3. Government					4. Education			5. Media		
LUS ID:	Farmer ID:	Cultural Heritage	Experi-ences	Other Farmer	National Progr.	Local Gov. Bandung	EWO	Parastatal Comp.	Forest Village Com. Inst.	Univ.	Primary School	Other	Books	TV	
	1				1		1							1	3
	2				1		1								2
	3					1	1								2
1	15				1		1							1	3
	4					1	1								2
	6	1		1		1	1								4
	9	1													1
	10			1											1
2	20	1				1						1			3
	17	1				1									2
	18					1									1
	19	1													1
	7	1													1
3	8				1										1
	5*		1										1		2
	11	1				1		1	1	1	1				6
	12			1			1	1		1					4
4	16	1						1							2
	13	1			1										2
5	14		1								1				2
	TOTAL:	9	2	3	5	7	7	3	1	2	2	1	1	2	

Table 4.3: Overview of the different information sources named by the farmers. In the first and second row of the table, the information sources found in the fields are categorized into the WOCAT categorization system and into an own compiled categorization system, based on the spatial and social distance of the individual to the information source. In the first column the Land Use Systems (LUS) ID are listed (1: *cut and carry with farming*, 2: *bushland with farming*, 3: *farming lowland*, 4: *agroforestry*, 5: *tea plantation*). In the second column, farmers of the sample are listed ordered by the LUS. National programmes: Farmer number 1, 2 and 15 talked about the 1981 founded programme called UPSA, farmer number 8 named the governmental programme called GAS, farmer number 13 talked about the SLPHT (*Sekolah Lapangan Pengendalian Hama Terpadu*) (English translation: farmer field school for pest control), which was organized by the local government of the province East Java and even was hold nationwide (all the programme are described later). Further local gov. Bandung means *local government of Bandung*; parastatal comp.: parastatal company (Perhum Perhutani); Forest Village Com. Inst.: Forest Village Community Institution; UNI: *university of Agriculture in Bogor*. The mentioned television programme of the information source TV called *"Siaran Pedesaan"* (English translation: rural broadcast).

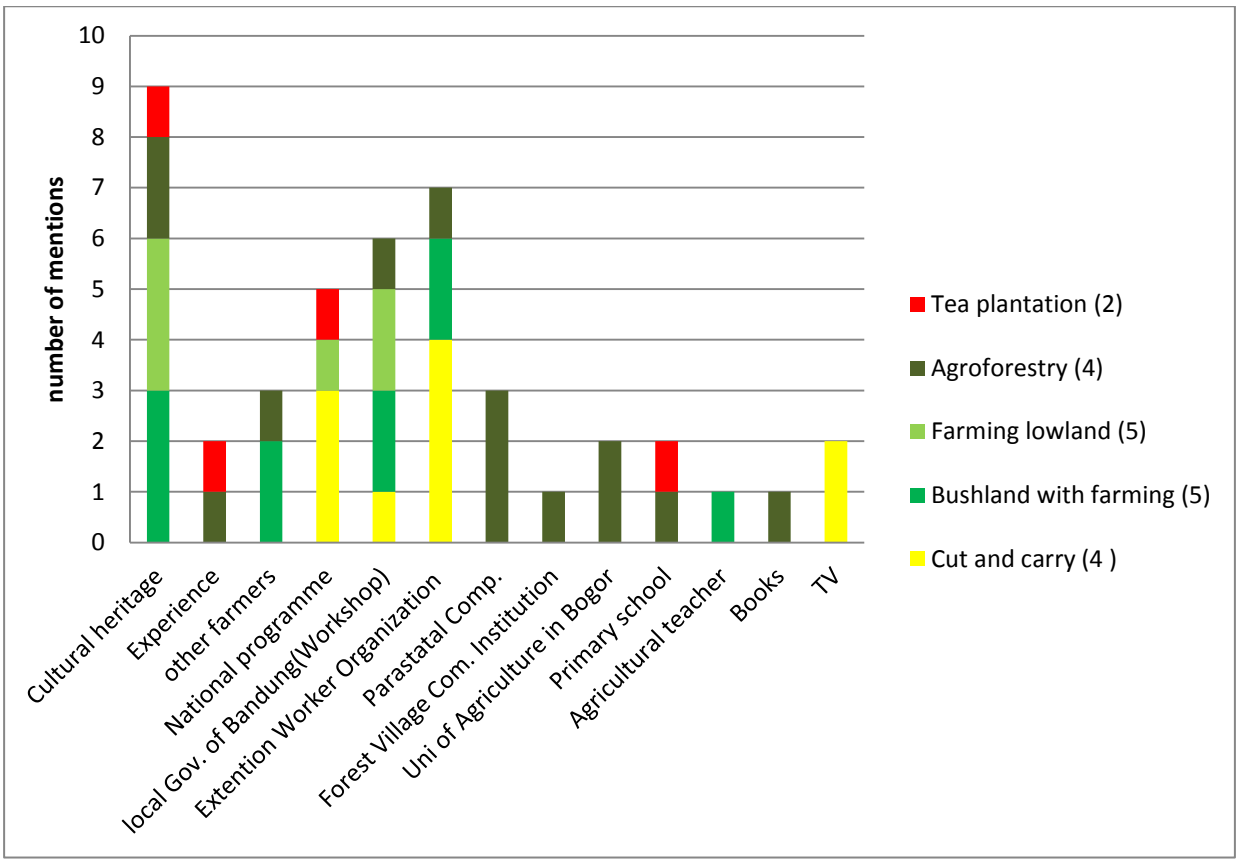


Figure 4.4: The 13 most important farmers` information sources for SWC by land use system. Multiple response, n=20. Number of mentions of the different information sources and by the LUS. It represents the under most row of Table 4.3.

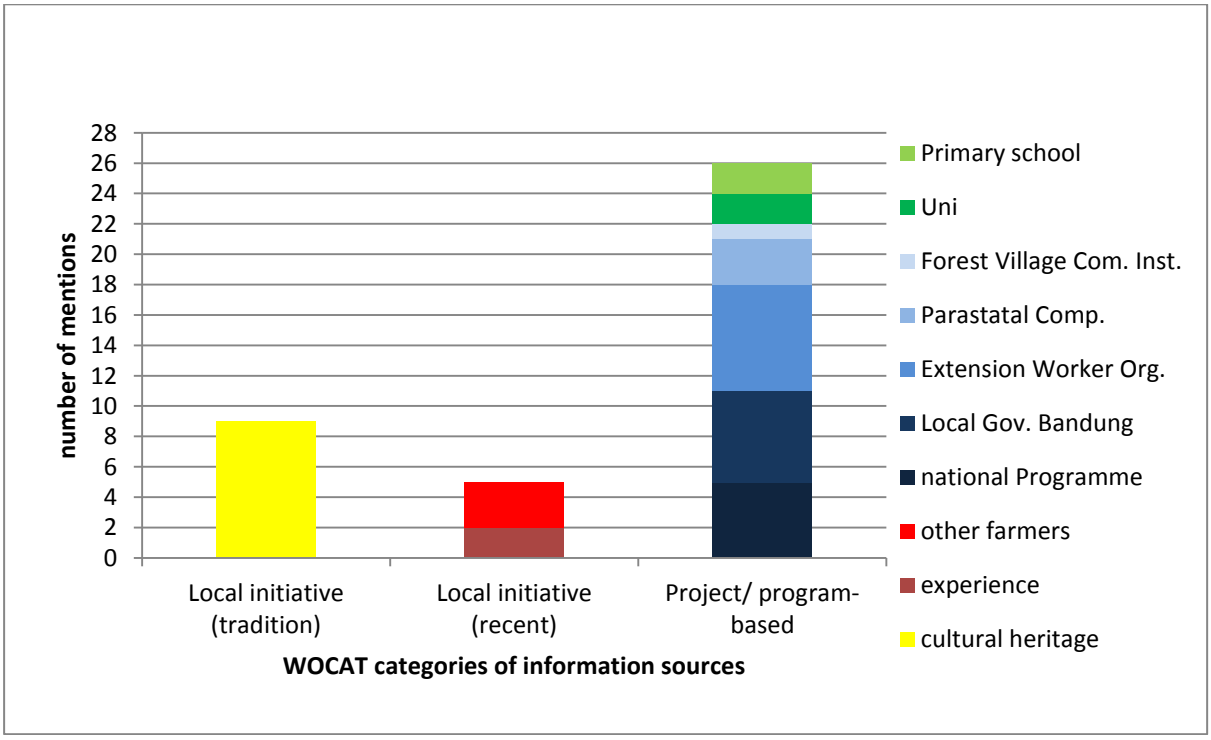


Figure 4.5: Farmers` information sources for SWC based on the WOCAT categories. Number of mentions, multiple response, n=20. The project/ programme based WOCAT category is the highest, adding up the single information sources.

4.2.2 Information Sources in Detail and their Spread

Family and Culture

The first category is *family/culture* and belongs to the WOCAT category 'local initiative (tradition)'. This category can be seen as the 'basis of learning' in terms of agriculture. Much information is transferred to the children by the parents, grandparents and the given information even refers to ancestral knowledge. Some farmers learned how to build terraces from their parents, for example. This information source is very important and sustainable because the indigenous and long-collected information, ***the cultural heritage***, is automatically given to the next generation (knowledge transfer). Additionally the fact that the transfer costs are nil, shows that this is a very good way to spread information in rural areas and over generations. Efforts should be made to protect this information source. For example the farmers are keeping personal diaries or field books about their agricultural practices. And of course, by the record of the technologies into the WOCAT database. According to the UNESCO (2008) (see Box 4.1) a cultural heritage can be categorized into tangible (movable, immovable and underwater) and intangible cultural heritage (oral traditions, performing arts, rituals etc.). In my research both categories are important and used in terms of agriculture by a society. The indigenous knowledge and its transfer to the next generation, according to the 'Ideal-typical linkage between society and land use system' by WIESMANN (1998) constitutes one of the four components that have to be complied to guarantee the continued existence of the society in rural Africa. (Peasant`s rational and strategy of action in actor-oriented perspective on regional development).

Box 4.1: **Cultural heritage**
"Having at one time referred exclusively to the monumental remains of cultures, heritage as a concept has gradually come to include new categories such as the intangible, ethnographic or industrial heritage. A noteworthy effort was subsequently made to extend the conceptualization and description of the intangible heritage. This is due to the fact that closer attention is now being paid to humankind, the dramatic arts, languages and traditional music, as well as to the informational, spiritual and philosophical systems upon which creations are based. The concept of heritage in our time accordingly is an open one, reflecting living culture every bit as much as that of the past." (UNESCO 2008)

Almost half of the farmers (45 percent) named this information source. It is the most mentioned one and therefore the most important (Table 4.3). It is also remarkable that this information source is named by none of the farmers in the land use system *cut and carry with farming*. This can be explained by the fact, that the soils and the climate in the present are dryer than before and due to these ecologic circumstances the traditional knowledge is not suitable or useful to the present

ecological conditions anymore. Another explanation could be, that the farmers had to produce in other zones than before because of the huge population pressure. An expansion of farming land into the upper regions of the watershed can be observed (PALTE 1989). Further, it is possible that the farmers erstwhile knowledge is not suitable anymore because the farmers had to change their products and land use systems according to the changes in the environment.

In the expert interview the society tradition was also mentioned and the local land users are the lead actors. The scope of tradition is local. In the region Ciwidey there are many unwritten rules in terms regarding agriculture and ecology, which are given to the younger generation by elderly persons. In Box 4.2 there is an example of such a cultural heritage mentioned in an expert interview.

Box 4.2: **Rules from ancient times in Ciwidey**

To protect the water resources in West Java the ancestors made up a rule for the society. This unwritten and inherited rule implies that if the people cut the trees near a water source, the people will get sick. In the society today some people still believe in this rule and others understand the rational explanation that this is an educational myth with a scientific reason behind this rule.

Near Environment

The second category can be named the *near environment*. It belongs to the WOCAT category 'local initiative (recent)'. In this category the information is learned and turned over most notably by observations and social learning. But there is no knowledge transfer from the past like in the information source *cultural heritage*; the learning process takes place in a person's lifetime. In this category I distinguish two information sources, the *experience* of the own doing and learning and the information source in which the information is given through other farmers. Information can be gained from other farmers by observation of a neighbours' technology and transferring it into the own field or by conversations and oral substitution of information between two farmers. To make one's own experiences and to learn from them is enhanced through curiosity.

According to the interviews, the *near environment* is not an information source category that is often mentioned. Five farmers (25 percent) mentioned this category. The information source ***experience*** was just mentioned twice by a farmer in the LUS *tea plantation* and Memet, the key farmer in the *agroforestry* LUS. The information source ***other farmer*** was mentioned by three farmers; two farmers acting in the LUS *bushland with farming* and the third in *agroforestry*. No farmer of the LUS *cut and carry with farming* or *farming lowland* named this information source.

In Box 4.3 Memet (key farmer) and his NGO are represented. Presently, he is initiating individual initiatives and is influential locally and even regionally.

Box 4.3: Memet and his NGO - an innovative personality and farmer

Memet Eyang is a key farmer and has an advisory role in the area. His NGO is called STARS (Satria Tatar Soenda) and had 10 000 members as of August 2010. For example in the state workshop he teaches about the philosophy to conserve nature. Additionally he organises a workshop for farmers twice a week to teach about good practices in agriculture. He is the leader of a farmer organization in the region and aims to "regreen" the land with his NGO. To finance his projects and activities he cultivates seedlings of different tree species (also indigenous) which he sells to other farmers and to the government. He gets financial support from the sponsoring bank "Banjabar" to realize his projects, they knew about his activities through the reforestation fund. Memet enjoys a very good reputation, often he is even regarded as a hero ("satria") by the people in the region. Memet is very well educated, sophisticated, intellectual, avant-garde, politically active, open minded, social, cares much about his fellow men and nature and is confident about his activities and beliefs (to care about and save nature in Indonesia and the whole world). He also is a "PencatSilat" fighter and has an organization for this Indonesian martial art, which also serves as an exercise for concentration and spiritual inspiration. He told me, that when his NGO plants trees, they do it in the uniform of the fighters because this people enjoy more respect. Also the military works with him, they do social work through the planting of trees. Also the "Bu Potani" (group of women in Ciwidey) works for Memet, because women, he says, can do better mechanical work like the fertilization or planting of trees. He reads a lot about SWC technologies in books and even wants to install internet in his house because he does not get enough information from the Dinas (the local government of Bandung). He is also planning to go to the University of Agriculture in Bogor to get more information about the SWC technologies. From 2005-2010 he planted 82 000 trees, he further told me that he wants to plant ten trees every day. In February 2010 he implemented an action called "Green for Best", working with the farmers in the area. He gave every member seedlings to plant them in an area of 60ha. He also rented the land for the members and asked them to plant the seedlings. He received no financial support from the government but paid for everything by himself.

Government

The rest of the information sources mentioned by the farmers all belong to the WOCAT based category 'project/ programme'. This category contains the *government, education and the media* of my own categorization; the government is somehow involved in all these subcategories.

My own category *government* contains all approaches introduced by the government and by its institutions and governmental programmes (see Table 4.3). Of course there is a mutual influence of the government and the individual, whereas the government as an actor is spatial and socially more remote than the above categories. The influence of these two actors is also not equal on both sides; we can detect the typical power relation between the state and the citizen. The government can be seen as a superiority that can decide something unilaterally and imposes its decisions on the farmers. This category contains the approaches in which the information about conservation agriculture and SWC technologies is spread by a nationwide governmental programme, a workshop held by the local government of Bandung (Dinas), through the local Extension Worker Organization (EWO) or other experts, through the parastatal company, Perhum Perhutani, and the Forest Village Community Institution (LMDH) (see also chapter 4.4.3.1). The EWO are the extension workers and agricultural advisors which are used to support the farmers with technical issues. The EWO and the extension workers in the field are regarded together as information source.

The most often mentioned information sources are the ones provided by the local government of Bandung: *the local* ***Extension Worker Organization (EWO)***, named by seven farmers (35 percent) and the Workshops hold by the ***local government of Bandung (dinas)***, named by six farmers (30 percent). The information source ***national programme*** was named by five farmers (25 percent). All farmers in the LUS *cut and carry with farming* were participants of the 1981 state programme called Unit Percontohan Sumber Dayer Alam (UPSA), farmers got incentives (money) for terracing the village land. The UPSA programme is only active in the LUS *cut and carry with farming* because here most erosion occurs due to the steep slopes and the relatively dry conditions. Farmer number 8 named the state programme GAS. In this programme the government built terraces to prevent damages to the roads and to prevent blockages. This programme aims to establish and secure the road infrastructure, sometimes by even using asphalt to make the transportation easier or even possible. The farmer field school Sekolah Lapangan Pengendalian Hama Teradu (SLPHT) mentioned by farmer number 13 was a farmer field school from the local government of Bandung for good practices in tea plantation in East Java. This training was held once a week during four months. Of course the ***Perhum Perhutani; the parastatal company*** which also manages the social forest in the secondary forest; was only mentioned by the farmers in the LUS *agroforestry* (secondary forest). Every coffee farmer has learnt something from the parastatal company Perhum Perhutani. According to MEMET, key farmer and NGO holder (2010) (Box 4.3) he does not plant trees in the secondary forest; he does not work with Perhum Perhutani and receives no information, we could state, that he is excluded from information source parastatal company. Moreover Memet himself holds classes and workshops about SWC technologies and 'regreening' for the farmers (MEMET, key farmer and NGO holder 2010).

The Forest Village Community Institution was just mentioned by one farmer in the *agroforestry* LUS; they are not active due to information spread about SWC technologies.

In the expert interviews nine different information sources were mentioned which were project or programme based and initiated by the government or through a NGO and therefore 'semi-governmental'. The scope of these approaches is regional or even national. In Box 4.4 and 4.5 the approaches mentioned in diverse expert interviews are described.

Box 4.4: Approaches mentioned in diverse expert interviews

Farmer field school (*sekolah lapang*) from USAID and ASGITA (2009)

This farmer field school was a partner project of the Association of Agribusiness and Tourism (ASGITA) and the United States Agency for International Development (USAID). During a session of a farmer field school an expert lives in a village for a certain period of time and teaches SWC technologies to the farmers directly on the field. The main goal of a farmer field school is the empowerment of the people, especially in the economic and institutional terms. The farmers learn how they can become independent. In this specific programme from USAID and ASGITA the expert teaches about plant cultivation (especially about the strawberry plant), how to manage pests and about SWC technologies in strawberry fields. This farmer field school was held during one month.

Farmer field school from BKP3 (May-July 2010)

Organization of Food Endurance and Information Executor of Indonesia (BKP3) is an extension worker organization and is under the control of the chief of the district of Bandung. The final goals from of this farmer field school are:

- Learning about good plants cultivation.
- How to manage pests with natural predators. For example: reduce rat with snakes.
- How to reduce the use of pesticides.
- Improve the farmer group and make them powerful, so they can increase their income.

In August 2010 there was an event named Agriculture Day (*hari krida pertanian)* in Soreang.
During this agricultural day, the extension workers of the regional government Bandung of the department of agriculture, horticulture and forestry organize an exhibition of agricultural products like for example strawberry jam or the biggest manioc plant produced. Each farmer group of the different villages has its own market stall. The main reason for this event to take place is to promote the agricultural products of the different farmer organizations and to exchange experiences of good practices in agricultural production.

Batu Namprak Bandung (BNB) (from 2002 till now)

The main focus of this NGO is to empower people not to be dependent just on environmental life. The types of activities are training or teaching (about conservation technologies, plant cultivation, product marketing), giving information and explanation about programme from the government and helping the farmer groups to be independent. Every month this NGO arranges a meeting with farmers or a farmer group in Ciwidey. The expert told me that the farmers recognize the benefit from this NGO

Go GREEN Provinsi Jawa Barat 2010 by the Institution of the Islam in Indonesia (lembaga dakwah islam indonesia(LDII)

This institution is seen as the voice of the Muslims in Indonesia. They have an action plan named 'Go Green' based on the Islam. In Muslim tradition there is a belief, that two days before a human being dies, he can choose to plant an Arabic palm tree to get the possibility to enter into heaven. To plant a tree is considered a good deed.

Box 4.5: Approaches mentioned in the expert interview with Mr. Andé of the Department of Agriculture, Horticulture and Forestry of the District Bandung.

Approaches of Rehabilitation Program of Critical Land (*Gerakan Rehabilitasi Lahan Kritis*, GRLK)

This approach is project/ programme based and was initiated in 2003. The GRLK and its activities aim to rehabilitate the critical land areas owned by the community through tree plantation and conservation of buildings and restore the land function and to increase the income of the farmers. They want to plant timber plants and multi-purpose tree species, build conservation constructions and multiply forest operations to produce different forest products. The stages of the implementation are the socialization of the activities, looking for suitable land and recording the farmers' surveys. They then begin with the institutional training, the main activities and at the end the monitoring and the evaluation. The main hindrance to implement the SWC technologies is the planting habits that are still embedded in society, regardless to conservation rules. Further the decrease in the farmers' income is also a problem. To overcome this constraint, alternatives to timber production are given to the farmers for example honey or wood mushroom production. The institutional constraint is that the handling of critical land is still not very integrated, but by involving the affected stakeholders with the rehabilitation activities this constraint can be overcome. There is also the problem that many farmers are just sharecroppers, but it is important to work with the land owners. The technical problem is that the traditional technologies still dominate the society, there has to be a knowledge transfer of the appropriate technologies. The decisions of the SLM technologies are chosen by the land user alone (bottom up) and national specialists designed the approach. There were differences in the participation of men and women because men do the rough work. The approach costs were financed 100 percent by the government and the regional budget. The annual budget for the SLM component of the Approach is 10`000-100`000 US Dollars. Demonstration areas were provided for the land users as technical support and promotion. Research was a moderate part of the Approach and the government provided the seedlings which were planted by the farmers.

Further Approaches are: Farmer Filed school for Conservation (sekolah lapang konservasi) and the Approach of Agroforestry. The answers of the WOCAT questionnaires are presented in Annex 3.

Education

The difference between the category *government* and education is that no implementations of SWC technologies are linked to this category here. This category contains all information sources, in which information is concretely taught in form of a lesson to the farmers in an institution in the present or in the past. The ***primary school, the University of Agriculture in Bogor*** or the ***recommendations of an agricultural teacher*** are mentioned information sources of this category (see Table 4.3). This category was not mentioned often by the farmers in the study area: while the local *primary schools* and the *University of Bogor* were listed twice, the information source *learning form an Agricultural teacher* was just mentioned by one farmer.

Media

The media contains information that is passed on without an interaction between two persons. The spatial and social distance between two actors can be small or huge; depending on the location and information content of the emitting institution. A farmer learned about the SWC technologies from a ***book*** and two farmers received some information from ***television***. The television agriculture programme called "Siaran Pedesaan" was emitted by the channel RRI TV. In terms of SWC technology the media radio was not mentioned. A reason could be that the SWC technologies are difficult to transmit without pictures, which is an advantageous instrument for teaching them. Even if not often, still three farmers named the media -and according to MR. ANDÉ, Departement of Forestry (2010) form the local government of Bandung, the media could have a very high potential to spread information. This information source was merely mentioned in the field.

4.2.3 Information Sources in the Different Land Use Systems

Farmers have at least one and up to six information sources (see Figure 4.6). The farmer with six different information sources is active in the LUS *agroforestry*. It is noticeable that in the LUS *cut and carry with farming* no information source in the category *family/culture* is given, whereas all the information sources found here are based on the government and are project/programme based. The reason here is, that the land is most affected by soil erosion due to its steep slopes according to WOCAT (2007). In addition, population pressure forced the people to use land, which is not suitable for agriculture. Deforestation of natural forests and land use change of grassland to pasture and due to this the resulting loss of the forests protective function as well the probable change of the climate and particularly the rainfall of an area make the land sensitive to soil erosion and degradation (DONNER 1987) "Anyway it is safe to say that a dense vegetative cover can be expected to `smooth` the climate; the rainfall and hence the run-off on the ground may become more balanced" (DONNER 1987). These circumstances also explain why the government is active particularly in this region to support farmers, who in the most cases are self-sufficient. All of the four farmers in the LUS *cut and carry with farming* mentioned the *EWO* information source and three of them named the UPSA programme, whereas contrary to the LUS *lowland with farming* and the *tea plantation* none of the farmers named the *EWO*.

Further in the LUS *bushland with farming* two out of five farmers mentioned the *EWO* and in the LUS *agroforestry* one out of four farmers. The information source *own experience, the Forest Village Community Institution, University, primary school, agricultural teacher, books,* and *television* were named just once or twice and are therefore not very widely spread. Having an agricultural teacher in these surroundings is rather seldom and it is not surprising that a farmer in the LUS *farming lowland*

named this information source. In this LUS, the possibility to have a person with a university degree is more probable because here the households are wealthier and have more probable financial resources for a better education. The *Forest Village Community Institution* was named by a farmer in the *agroforestry* LUS; as might be expected only the forest farmer organizations act in this LUS. Further the *University* and *primary school* as an information source were all named merely in the LUS *agroforestry*; the reason could be that the sensitization to protect the forests is much more advanced due to the international agenda of the deforestation problem, than for example soil erosion. Learning from *own experiences* and from *books* were both mentioned by Memet, a sophisticated environmental activist. *Cultural heritage* is the most mentioned information source in the sample and therefore very important in this region. In the LUS *bushland with farming* and the *farming lowland* three out of five farmers, in the *agroforestry* two out of four farmers and one out of two farmers in the *tea plantation* named *cultural heritage* as an information source. The *cultural heritage* is the information source, which is most often combined by other information sources. We can say that the indigenous knowledge mediated by the parents often represents a base which is combined with other information sources as there are always available and influencing the technologies. Looking at the category *near environment*, the information generation out of *other farmers* was named by two out of five farmers in the LUS *bushland with farming* and by one out of the four farmers in the *agroforestry*. For a better understanding of the possible reasons a bigger sample is needed. The parastratal company, as explained before, only acts in the LUS *agroforestry* in the secondary forest. In the category *media*, *television* as information source was named by only two farmers in the LUS *cut and carry with farming* and the information source *book* just by the key farmer and NGO holder Memet, who belongs to the LUS *agroforestry*. The *workshops of the local government of Bandung* are thinly spread over all LUS except in the LUS *tea plantation*, here the Research Centre of the State Company for Tea (PTPN 8) is responsible, if at all, for information spread.

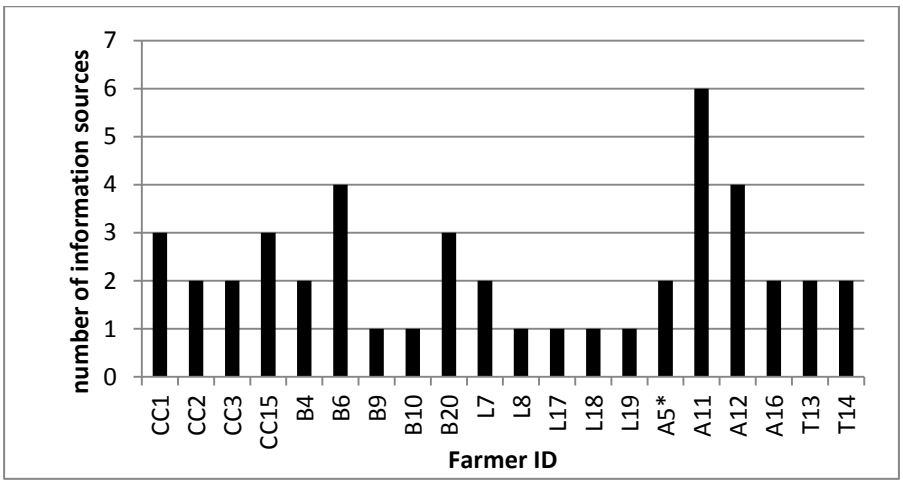


Figure 4.6: the number of used information sources by the particular farmers. The farmers are organized by the same LUS CC: cut and carry with farming, B: bushland with farming, L: farming lowland, A: agroforestry and T: tea plantation.

4.2.4 Concluding Remarks

Finally we are able to conclude, that the *cultural heritage* is a very important information source as it is (also) the most mentioned one. The information source *EWO*, workshops of the *local government of Bandung* and the government were all named by at least 25 percent of the sample. Therefore it may be assumed that the *family/ culture* and the *government* are the most important information source categories of my own categorization system concerning information about agriculture and SWC technologies. Other information sources belonging to the categories *near environment*, *education* and *media* exist but have less priority *(*Figure 4.4). Regarding my results, the *family/ culture* is an important information source in terms of SWC. But it is important not to overestimate the family and culture in terms of SWC information spread because this information channel alone is not sufficient regarding the present high soil erosion and degradation. Other information sources, for example farmer field schools, are needed because the small scale farmers - especially the self-sufficient ones - will be confronted with new ecological conditions in the future, due to the expansion into more steep areas due to high population pressure and will need help in terms of SWC.

4.3 What are the Reasons to Practice SWC? - in the Farmer`s Eyes

In the following chapter, I try to find out why the farmers use the SWC technologies or not. It is a matter of the farmer's perception of SWC technologies. First the farmer's expectations of these technologies are illustrated, followed by the advantages and the disadvantages recognized after the utilization of the technologies. At this point the farmers are talking about their past experiences. Further the limiting factors, which avert the farmers to improve their SWC technologies or to implement more, are discussed. The individual mentions are always marked with colours depending to which LUS the farmer belongs. To make more concrete statements and for better comprehension, a more representative sample has to be interviewed.

4.3.1 Expectations

The interview question: 'what is your expectation of SWC technologies?' was answered by all the twenty farmers of my sample. In Figure 4.7 the mentioned expectations are listed in the horizontal axis and the number of expectation by the farmers in the vertical axis. It is very interesting to analyse the expectations of the farmers in terms of the application of SWC technologies because it is useful for the understanding of SWC and the needs of the farmers. With this information, the SWC technologies can be adapted to the needs of the farmers and it can help to promote the SWC technologies. In summary, five concrete expectations are mentioned: *prevent erosion, obtain higher crop yield, increase the soil fertility and soil moisture* and *to cut the slope* (see Figure 4.7). Additionally the category *other* contains various expectations.

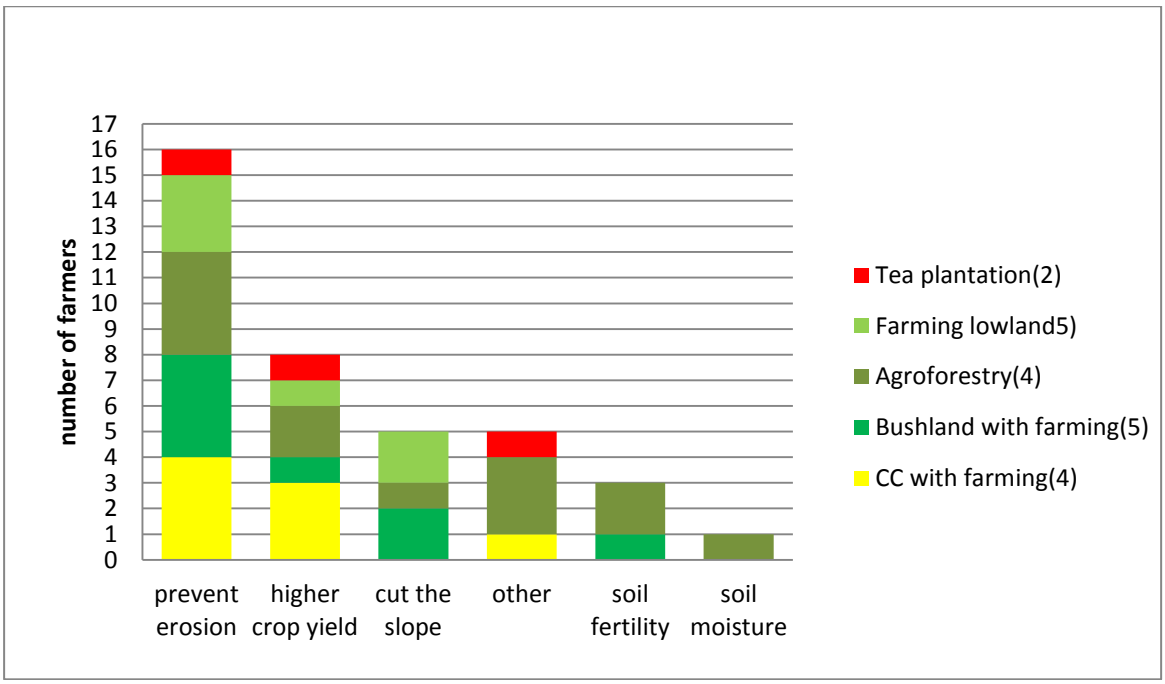


Figure 4.7: Farmer`s expectations relating to SWC technologies utilization, mentioned in the interview. The number of mentions of each statement is categorized into the LUS belonging of the farmer. On the right the numbers of the farmers in each LUS are written in brackets. Multiple response, n=20.

The most mentioned expectation is to ***prevent erosion*** due to SWC technologies. This expectation was mentioned by farmers in all LUSs. This category was mentioned twice as much as the second most mentioned category *higher crop yield* (16 times) and seems to be the most relevant one in terms of SWC in the farmer`s understanding, which is not self-evident. We can see that in the farmers understanding there is a direct link between the SWC technologies, preventing erosion and further to protect nature. A possible explanation could be the influence by many SWC activities in this region and the emphasis on this context by the teaching organization or institution. Another reason also could be that the farmers mentioned this expectation because they knew that the reason of my visit was to perform research on soil erosion and were automatically sensitized. Maybe they mentioned what they thought I wanted to hear. The statements to prevent runoff and landslides were also put into this category.

The second most often mentioned expectation ***higher crop yield*** or to increase the harvest, was also named by farmers of each LUS. Of course the farmers need to see a positive outcome for applying SWC technologies and therefore this statement is not astonishing. If we cannot implement SWC technologies which yield a profit in short-term, it is important to communicate so to the famers; to reduce the risk that the farmers stop practicing the SWC technologies which at the beginning often decrease the harvest. Also financial support at the beginning of the application of SWC technologies could help to persuade the farmers. These two most often named expectations are indirectly connected- if there is less or no erosion, consequently the crop yield can be higher compared with

the more damaged land. Just two farmers did not name the expectation *higher crop yield* in combination with the expectation *prevent erosion*, whereas the expectation *prevent erosion* is named 13 times alone. Thus erosion seems to be a noticeable problem in this area.

The following categories are mentioned one to five times and are not very important. The expectation ***cut the slope*** was mentioned five times. This statement meant that the farmers expected to work more easily on the fields and to collect the harvest more easily by levelling the slope. The category ***soil fertility*** was only mentioned three times. This is astonishing due to the big soil fertility decrease in this region and the statements that indicate the high use of fertilizer, especially in the LUS cut and *carry with farming, bushland with farming* and *farming lowland.* Maybe the soil fertility is not linked with SWC technologies in the farmer's knowledge. There is a big potential to promote SWC technologies with the statement that the technologies increase the soil fertility, especially in the LUS cut and carry with farming. The expectation ***soil moisture*** was just mentioned by one farmer of the LUS agroforestry and is not perceived as important by the rest of the farmers. The collective category ***other*** contains the statements: *protect the nature*, *conserve the forest*, *get a certificate*. The personal belief to protect the nature was mentioned by Memet, the active famer who is undertaking projects to regreen the region around Bandung. Two farmers, one in the agroforestry LUS and one in the tea plantation LUS, expect to get a certificate because they use SWC technologies. A certificate would increase their reputation or even make it possible for them to sell their products at a higher price. One farmer in the LUS *agroforestry* mentioned the expectation to conserve forest, according to my own observations this farmer was a person who really cared about the future of the nature in Indonesia. Additionally he and his fellow men are also mediators between the farmer organization and the forest farmer groups.

It is conspicuous that the expectations of SWC technologies are the highest and most diverse in the LUS *agroforestry*. Further we have to bring up the fact, that in the LUS *agroforestry* there are two farmers of the sample which are very interested in the environment and sustainability and that the activities of the parastatal company, Perhum Perhutani, which manages the social forest, is very frequent. For this reason the expectations of the farmers are notably pronounced. In the LUS *bushland with farming* all the expectations were mentioned except the categories *soil moisture* and *other*. In the LUS *bushland with farming* the soils were wet enough. This can be explained by the humid climate and the high plant coverage of bushes and shrubs. The farmers in the LUS *cut and carry with farming* and *tea plantations* just expect to prevent erosion and to obtain a higher crop yield. This shows that in the eye of the farmers in this LUS the erosion is the biggest problem. The high erosion can be explained by the steep fields and the proximity of the deforestation area of the

secondary forest. In a further study it would be very interesting to find out from where the farmers generate their expectations.

4.3.2 Advantages of SWC Technologies

17 of the 20 interviewed farmers made a statement to the question: 'What was the advantage of the utilization of the SWC technologies?' In Figure 4.8 the mentioned advantages are listed in the horizontal axis and the number of mentions of the advantages by the farmers in the vertical axis. Nine different advantages were mentioned in the interviews: *better soil moisture, harvest increase, better soil fertility, regreening, decrease the runoff, cut the slope, decrease erosion, slope stabilization* and *additional products* (see Figure 4.8). The advantages represent the real outcomes of the SWC technologies, which are perceived by the farmers.

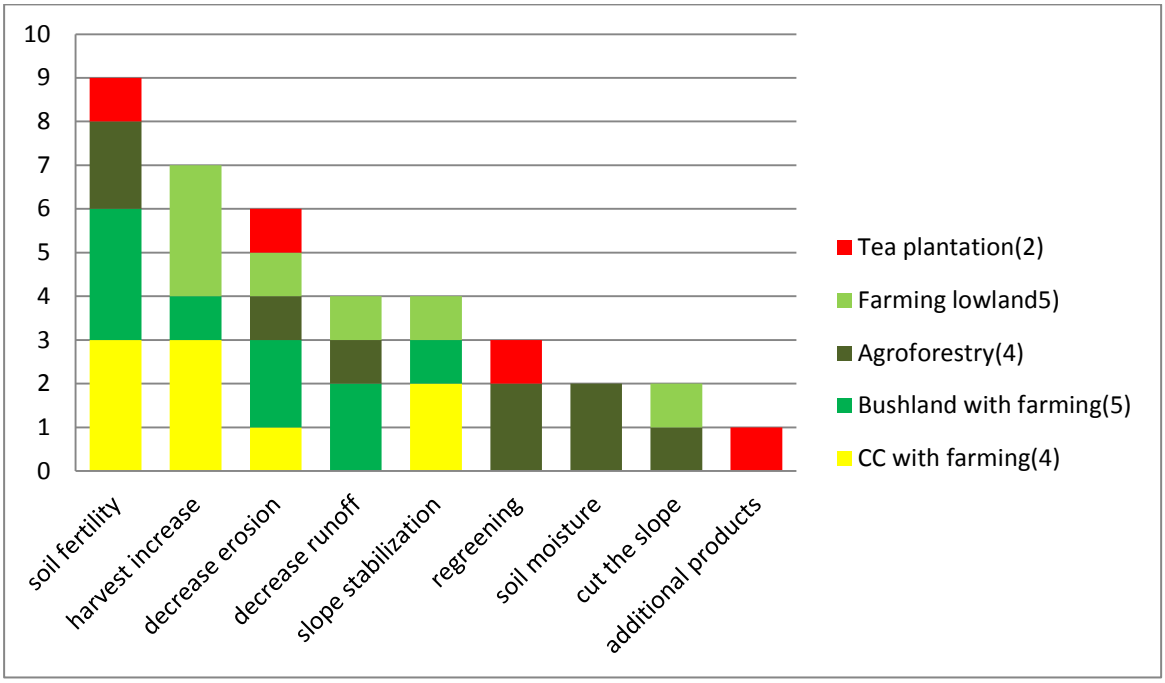


Figure 4.8: Distribution of the advantages after using SWC technologies as seen by farmers, mentioned in the farmer interviews. The farmers are categorized into the corresponding LUS, multiple response, n=20.

In every LUS at least four different advantages were mentioned and up to six in the LUS *agroforestry*. The advantage most often mentioned is *soil fertility increase*; the second is *harvest increase* and the third *erosion decrease*. The advantage, ***soil fertility*** was mentioned by farmers of every LUS, except by the one *farming lowland*. Further, the *soil fertility* and the ***harvest increase*** are connected directly; we can state that after making the soil more fertile, the harvest will increase. So maybe in a few years even more farmers would say that the harvest increased through the SWC technologies since its implementation. The ***erosion decrease*** is the only advantage mentioned by farmers from every LUS. We can assume that the SWC technologies were successful. The *soil moisture increase* and

additional products were just mentioned by farmers of one LUS and the rest of the advantages were named by farmers of two or three LUS. They are less important. Considering the big number of mentioned advantages, we can say that the SWC technologies are successful and are valued as positive by the farmers.

4.3.3 Disadvantages

Just three farmers (two from the LUS *cut and carry with farming* and one from the LUS *farming lowland*) answered the question: 'what are the disadvantages of the SWC technologies?' The fact that only three farmers named a disadvantage of the SWC technologies leads us to the conclusion that the farmers are satisfied with the use of the SWC technologies and see them positively as also concluded before. Still everyone mentioned a ***harvest decrease*** and farmer number 2 from the LUS *cut and carry with farming*, also complained about not having sufficient food availability. Only farmer number 3 from the LUS *cut and carry with farming* complained that beside the harvest decrease also the ***runoff increased*** since the implementation, he was the only farmer, who all in all evaluated the SWC technologies as negative. Additionally he said that the technologies are ***very labour and money-intensive***. Two of four farmers from the LUS *cut and carry with farming* mentioned disadvantages (*harvest decrease, more runoff, time and money intensive*) and one of them (farmer number 3) even evaluated the SWC technologies as negative; this is an alarming result due to the fact that especially in this LUS, SWC should take place in order to deal with the erosion problem. Due to the very small number of answers, general statements cannot be made.

4.3.4 Limiting Factors

17 of 20 farmers made a statement in the interview to the question: 'Which is the limiting factor not to use SWC technologies in the field?' In Figure 4.9 the mentioned limiting factors are listed in the horizontal axis and the number of mentions of the limiting factors by the farmers in the vertical axis. None of the three farmers who did not give an answer are from the LUS *farming lowland*. This LUS also seems to be the most profitable and the farmer`s production orientation is always at least partly commercial, here the farmers are richer than in the upper zones. According to ADININGSIH AND SYARIFUDDIN KARAMA (1992) the upper zone, which is dependent on upland agriculture, constitutes the poorest strata of the rural population. The mentioned limiting factors are *lack of money, land, knowledge, manpower* and *time* (see Figure 4.9).

Money is clearly the most mentioned limiting factor, mentioned by 11 farmers in all LUSs. The second most named limiting factor is ***knowledge*** and was mentioned by four farmers: two from the LUS *bushland with farming*, one from the LUS *tea plantation* and one form the LUS *cut and carry with*

farming. This shows that the farmers are asking for more knowledge about SWC and are motivated to learn. Statements of the category ***land*** are: not to have more land to work on or that the land is too steep. This category was mentioned three times. Maybe this is a result of the high population growth, which led to a smaller size of the fields than before. The limiting factor ***time*** was mentioned three times as well. Farmer number 12 named the limiting factor *time* because he is engaged in more activities (for example tourist guide), like in the case of farmer number 10 and 14. ***Manpower*** was just mentioned by one farmer from the LUS *farming lowland* and is therefore not an important limiting factor although many experts suppose this factor to be often limiting.

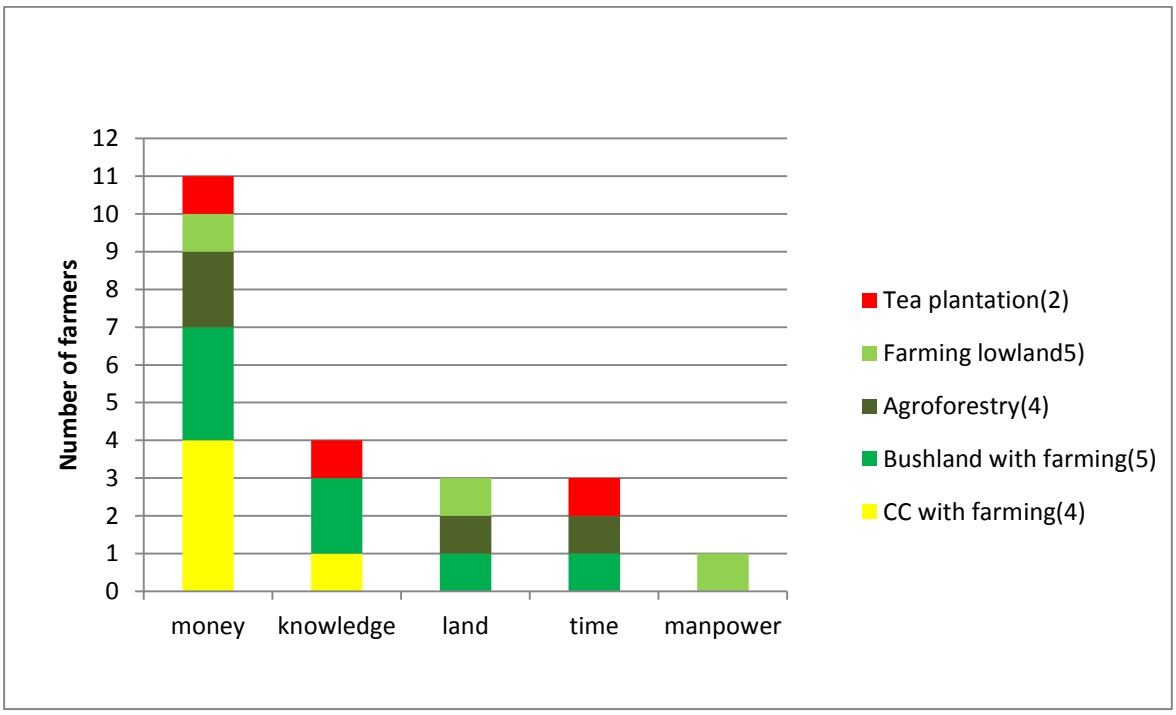


Figure 4.9: Limiting factors for implementing SWC technologies as seen by farmers in the field. Multiple response, n=20.

4.4 What are the Characteristics of the Farmer`s Livelihoods?

4.4.1 Vulnerability Context

The information about the vulnerability of the farmers was generated by the farmer interviews during the field work in 2010.

Shocks

18 farmers of the whole sample (20 farmers) could remember a shock in the past. Most of the farmers remembered between one and two different shocks; just one farmer number 14 mentioned three. Six main shocks could be identified: the *earthquake 2009, floods, runoff/ landslides, pests, stealing* and *animal attacks*. As we can see in Figure 4.10, the most often mentioned category *runoff/landslides* was named by nine different farmers. At the same time it is the most crucial one for SWC technologies because in a heavy runoff the installations and constructions like, for example terraces can be washed away. The following three categories are *pests*, with six mentions, *earthquake*, named by five farmers, and *floods*, named by five farmers. *Stealing* and *animal attacks* were just mentioned twice and are therefore not very important. The *animal attacks* and *stealing* were all found in the *agroforestry* LUS.

Heavy ***runoff and landslides*** are put together into one category, because these two shocks are closely connected to each other. It is also important to say, that according to the statements of the farmers, heavy *runoffs*, a *landslide* or heavy erosion happens after a heavy rainfall. One of the farmers also reported heavy winds, and that many trees fell before the big runoff and erosion occurred. Here the farmer was talking about a storm. The latest runoff mentioned by farmer number 2 happened in 1985. Two farmers (number 8 and 10) lost 100 percent of the harvest because of a runoff, sadly in one of the calamities a girl died and in the other all the installations (level bench terrace) in the fields were destroyed. Four other farmers reported a harvest loss of 10 to 20 percent and one farmer mentioned even that every year a destroying runoff happens in his fields. To find out more about the effects and the dimensions of the runoffs and landslides more investigations should be carried out.

The ***pest*** shocks are very variable depending on the kind of pest (and the plants they attack). The mentioned harvest losses due to the pest are mostly very high, from 50 to 100 percent. Also here, more investigations are necessary to specify the kinds and the connected problems of the pests. At this point I would like to mention the Integrated Pest Management (IPM) plan of Indonesia and would like to refer to its website: http://www.globaleducation.edna.edu.au/globaled/go/pid/846/.

This web page gives information on the background of the Indonesian IPM of the government and gives good information on farmer field schools and its impacts.

Four of the five farmers, who were talking about an ***earthquake*** referred to the one in the year 2009, the fifth farmer, referred to an earthquake in 2010. The first mentioned earthquake occurred on the 2 September 2009 at 2:55 pm local time. The epicentre was just 100 km south southwest of Bandung out in the Indian sea and was a 7 magnitude earthquake. For further information see page: http://earthquake.usgs.gov/earthquakes/recenteqsww/Quakes/us2009lbat.php. None of the farmers had any damages in the fields but all the houses of the farmers who mentioned an earthquake had fissures in the walls.

All the farmers who mentioned the shock ***flood*** stated heavy damage in their fields. Farmer number 4 reported that the flood flowed into the rice fields and that he lost all his harvest. To ensure the food availability of his household he had to work on other farmers' field but until today he still feels the effect of this flood. Farmer number 17 also lost all his harvest and 40 percent of the field installations (mainly terraces) were damaged. The fields or harvests of the other two farmers who mentioned the floods were not affected, but they reported that many houses were flooded away.

The key farmer Memet mentioned that sometimes people ***steal*** leaves from his trees for fodder for their livestock. According to Memet this can often be a reason for the trees to die. Farmer number 17 even reported the stealing of products from his private fields. It is conceivable that this happened because of high poverty.

Memet also reports about monkey problems in the transition zone of the farming and the secondary forest, where the monkeys come further down the mountains to steal the fruits from the farmers because of lack of trees and fodder in the decreasing secondary forest. Another ***animal attack*** is a pig attack, which took place in 2009 in the secondary forest. One of the coffee farmers lost many coffee trees because the animals dug out the roots of the plants.

Apart from these main categories of shocks, farmer number 13 mentioned an abnormal long dry period in the years 1987 and 1997. The same farmer also talked about the eruption of the Galungung volcano in 1979, where many tea shrubs died because of covering dust. He lost 100 percent of his harvest and also a lot of livestock died.

In summary we can say that three of the six most mentioned shocks (runoff/landslides, pest and floods) affect SWC technologies and have to be integrated into the technologies and even into the corresponding approaches. For example the terraces should be constructed in a way that steps are not washed away in a heavy runoff by a good stabilization solution like for example cementing the steps or by stabilizing them with bamboo sticks.

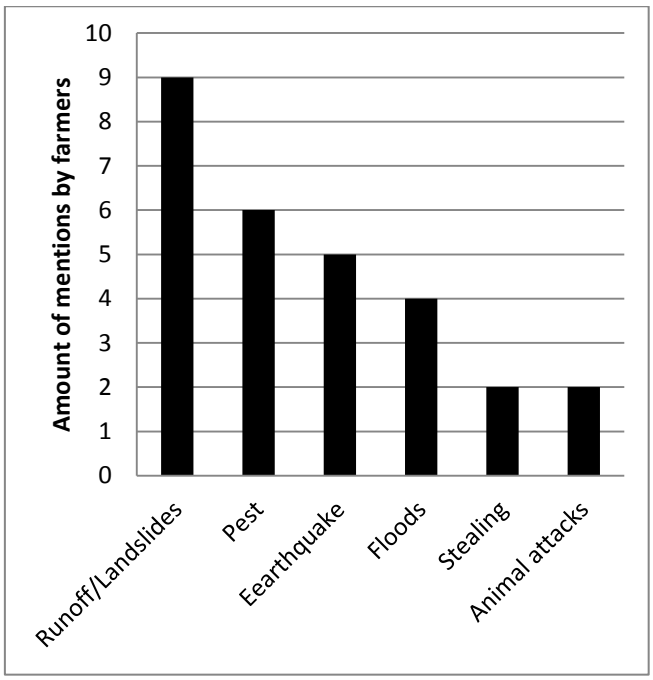


Figure 4.10: Illustration of the different shocks mentioned within the farmer interviews. Multiple response, n=20.

Trends

18 of the 20 interviewed farmers reported trends in the past decades. The number of recognized trends by farmers is between one and four. All the answers were put into six categories which are presented in Figure 4.11 below.

Most statements were on observations of the *weather* (nine farmers), then about *pests* (eight farmers); the *price level* (six farmers) and *agriculture* (six farmers). Trends about *population* and *infrastructure* were made only once or twice and are therefore not very important in the perception of the farmers.

Many farmers reported that the ***weather*** is not predictable anymore. According to the farmers, there are many extreme events like heavy rainfall and more runoffs than in the past. Two farmers report that the dry season is much wetter than in the past. These conditions are not favourable because farmers have to adapt to new weather conditions and due to the extreme events, installations like terraces and other SWC technologies can be damaged more easily. Due to the changing weather conditions, management measures in terms of SWC technologies and soil degradation will become more important and sometimes different plants should be planted which are more suitable to the new weather conditions. Here a financial support or provision of manpower could lead to better SWC technologies or help to rebuild them after a heavy runoff, flood or landslide. We can assume that the weather is changing and the small scale farmers in the region are facing a huge challenge. Many experts would expect this trend due to the strong deforestation in the secondary and primary forest where the water cannot be absorbed into the soil. Here the whole ecosystem is disturbed and not in

balance anymore. Also other effects like change of land use and the intensification of agriculture may lead to ecological change. Finding out how far this factor or climate change is influencing the ecosystems would be interesting.

Six farmers observed that the ***pests'*** existence increased and that the pests are more resistant and stronger- also more of the harvest is affected. Only one farmer in the LUS *farming lowland* reported that the pests could be controlled better. It is important to mention that in the LUS *farming lowland* the farmers tend to be richer than in the upper regions and therefore can use more pesticides.
All of the farmers reported that the ***price level*** increased. Materials for SWC technologies like stones, seedlings and manpower are more expensive than in the past. Also fertilizer is said to be more expensive and the use of it is therefore limited.
Only one farmer commented that the economic condition today is better. Concerning the ***agriculture*** and agricultural practices, five out of six farmers reported a positive development; they were talking about the ph-value of the soil, the use of organic fertilizer, the management of the farmers' activities, the knowledge on agricultural practices and the vegetation cover. Just one of the farmers reported a decrease of soil quality due to intensive use and also commented that the harvest had decreased. I would like to bring up the question if the farmers were telling the truth; maybe the farmers were talking mostly positive about the agricultural development because of the presence of the extension workers- the information medium of the regional and national government for agricultural knowledge.
Only one farmer commented that there is increased migration into the city of Bandung. I also observed young people migrating to the urban zones, but due to the huge ***population*** increase the availability of manpower in the agriculture is not much affected. One farmer commented on the rapid and permanent population growth and one farmer commented on the fact that the ***infrastructure***s, especially the roads, are better today. The improvement of the roads can lead to positive and negative effects. On the one hand transportation and access to traditional markets can be improved and the livelihood of the farmers increased, but on the other hand the effects for nature can be very crucial. Due to road constructions the soil is compacted and sealed with cement which has negative effects on the water absorption. A second indirect effect is the expansion of the population enhanced by a better access by newly constructed roads for more remote areas. Farmers can reach the more remote areas more easily and change natural ecosystems into agricultural land or even settlements.

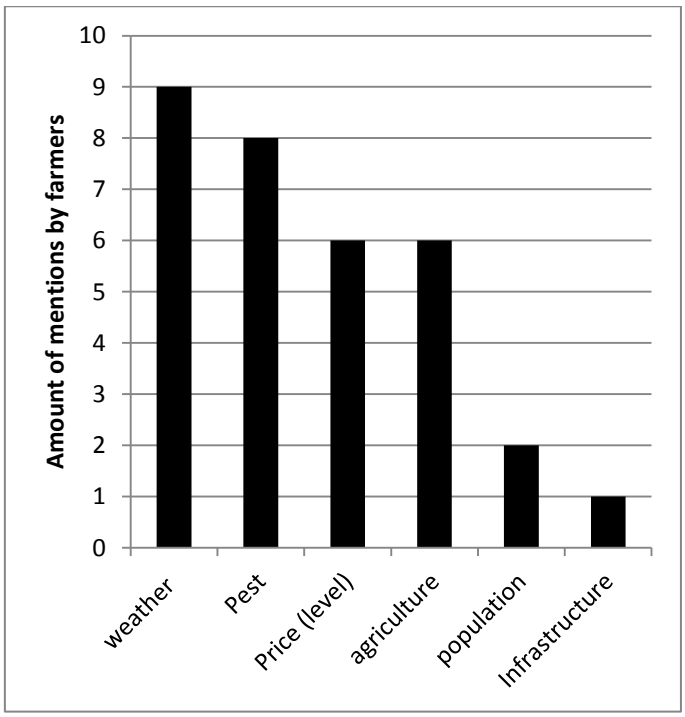


Figure 4.11: An overview of the categories of the mentioned trends worked out by using the farmer interviews. Multiple response, n=20.

Seasonality

Every farmer had something to report on seasonality. Five different categories of the statements about seasonality could be identified: *prices, production, pest, health* and *job*. Most of the farmers mentioned different categories. The statements were diverse and hard to categorize.

Many farmers reported that the harvest in the wet season is bigger than in the dry season, - and due to the bigger availability of products the prices are lower. Also job opportunities in agriculture are better in the wet season because during this period the farmers need more help in their fields. During the wet season there is often too much water and many agricultural products are spoilt because the water cannot infiltrate in the soils. During the wet season most of the extreme weather events which lead to extreme runoffs, floods and landslides occur as said before. Therefore most of the damage of installations for SWC technologies falls into this time. We can assume that on the one hand in the wet season the production is better due to sufficient water but on the other hand it can also easily be affected due to too much water. If a harvest is better or not of course also depends on the specific product. For example, tea production is smaller in the wet season and pests are more frequent. According to the farmers the coffee trees grow better in the wet season but the beans are grown better in the dry season. The rest of the products grow faster in the wet season. Further the farmers reported a better health condition in the dry season which can be explained by the higher

temperatures and the dryness during this period, which leads to a lower liability to colds and flues. This means that in the dry season manpower is healthier and SWC technologies are rebuilt easier.

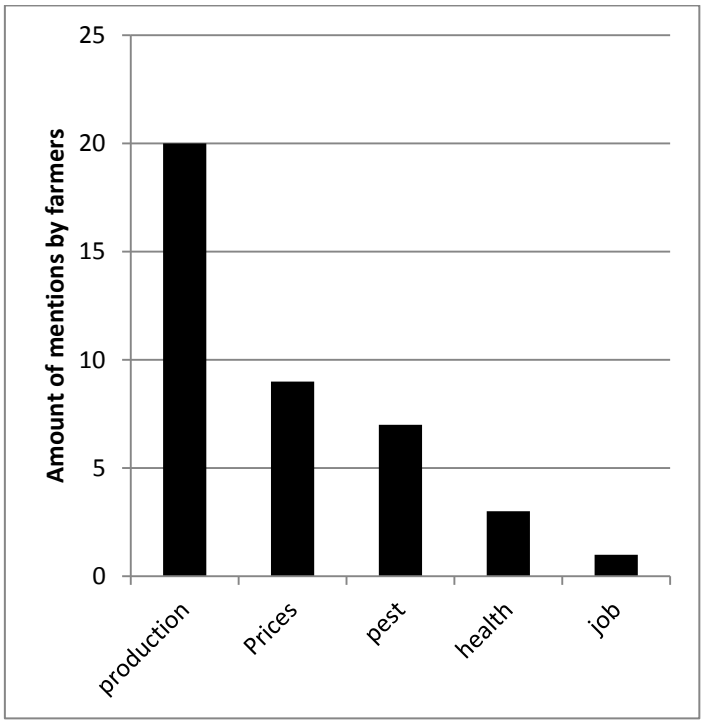


Figure 4.12: Overview of the categories of the mentioned seasonalities by the farmers. Multiple response, n=20.

4.4.2 Livelihood Assets

The livelihood assets are distinguished into five different capitals: human-, social-, natural-, physical- and the financial capital (see Chapter 2.1.3). In Table 4.4 an overview of the composition of the five capitals is given. The indicators of the current capitals had to be defined due to the available information of the farmers and are chosen in terms of the research questions. All the indicators present factors, which can be important for SWC technologies implementation. The distribution of the strength of the capitals describes the situation of the farmers, their needs and potentials. The analysis of the disposal of the capitals finally helps to understand where the farmers have to be supported, concerning the implementation of SWC technologies, where the farmers need support from outside in general to increase assets and where the approaches have to take place.

To make more concrete statements about the strengths and weaknesses of the different capitals in general, more farmers should be interviewed in a further study. The following results are based on the answers of my sample, which was small.

Human capital	Age, HH size (including children over 6 years), certificate
Social capital	member of organization, Family size, presence of certificate (honor)
Natural capital	Land tenure, land condition, land size
Physical capital	presence of a motorbike or a car, basic assets for land preparation, access to media
Financial capital	Incentives, family support/remittance, HH combination

Table 4.4: The five different capitals and the used indicators.

To analyse the typical distribution of assets of the farmers, the farmers were categorized into two zones: the middle zone and the upper zone. In both zones there are 10 farmers and a comparison is possible. The middle zone consists of the LUSs *farming lowland* and *bushland with farming* and the upper zone consists of the LUSs *cut and carry with farming*, *bushland with farming*, *tea plantation* and *agroforestry*. The land in the upper region is less arable due to the steepness and often represents drier climatic condition. In general we can assume that cultivation in a steep area is more difficult than in a plain area. The steep land is also more affected by runoff and landslides. This fact leads to a bigger vulnerability of the farmer`s livelihood. The strawberry farmers are active in the LUS *farming lowland*. Although the secondary forest, the LUS *agroforestry*, is situated in the upper zones, the coffee farmers mostly live in the LUS *farming lowland* and plant additional coffee in the forests. We can conclude that a division of the farmers into upper and lower zone is in reality very difficult because many farmers are active in different LUS and zones, nevertheless gives us the information that generally the upper land is disadvantaged by its natural conditions.

The star diagram (Figure 4.13) shows the distribution of the different capitals of each farmer. Every farmer of the sample has his own star diagram according to the strength of his five capitals. Colours indicate the farmers belonging to the same LUS. All the capitals were put into the same scale (1-10) and therefore the capitals are relatively comparable to each other. A large range of a capital signifies that the distribution of a capital among the farmers is very diverse and that there is a big difference between the farmers relating to an asset. In a situation like this social tensions are often present. At first sight we can recognize a huge variation of the farmers` distribution of the capitals, this implicates that many different livelihoods and capital resources are found in the region.

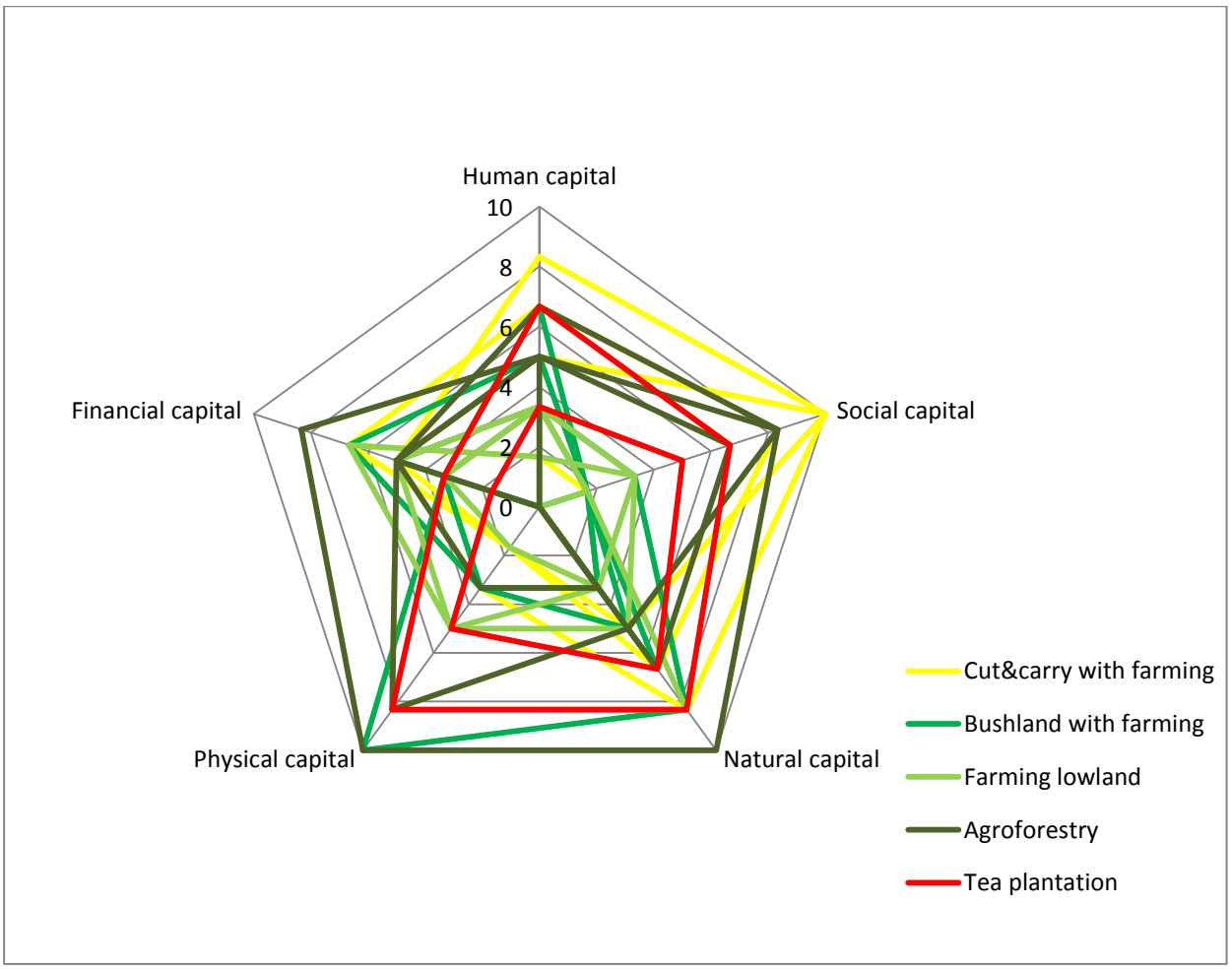


Figure 4.13: Distribution of the livelihood assets by farmer. The assets are divided into the five capitals (human-, social-, natural-, physical- and financial capital). All farmers of the same LUS are market with the same colour. 20 farmers were interviewed.

I would now like to discuss the distribution of the capitals looking at the middle and upper zone. To highlight the differences between the two zones, the corresponding median and average are also presented. Looking at the Figure 4.15, the medians and average values are very close to each other. All capitals, except the physical capital, are higher in the upper zone which is remarkable. In the following I will discuss the different capitals regarding the capital indicators.

The social capital is much higher in the upper zone. This is because the area is more rural than in the middle zone and is much more remote, whereas the middle zone could be compared to periurban agriculture zone, especially the LUS *farming lowland*. The farmers in the upper zone are more dependent on their own labour force and therefore have bigger family sizes. Further they also depend on reciprocity of their neighbours and the relationship seems to be closer. In this zone I could observe poorer livelihoods.

On average the farmers in the upper zone were younger than the farmers in the middle zone. This difference of age leads to a biased human capital. To eliminate this bias, the age distribution of the sample in both zones should have been the same. All farmers in the upper zone except two hold at least one certificate. This can be explained by the fact, that in this zone more governmental efforts concerning SWC are realized (see Table 4.3). Especially in the LUS *cut and carry with farming* the most efforts are made concerning SWC, because here we find the steepest zones and therefore the most endangered area for soil degradation. Here most of the runoffs and landslides take place. Hence most workshops take place and most certificates are given here.

The natural capital is higher in the upper zone. All lands in the LUS *cut and carry with farming* and *tea plantations* are private. Due to private tenure many experts would expect that these farmers care more about their land. For this reason, most governmental activities concerning SWC should take place here because of good results through caring about their life resources. On the contrary all the fields in the LUS *agroforestry* belong to the state, are managed by the parastatal company, Perhum Perhutani, and are larger. The land sizes are larger on average in the upper zone. The indicator 'land condition' seems to be balanced in both zones and is not determining. In the upper zones there are no differences in property situations; houses in the upper region are almost the same. It has also to be said that the land sizes in the LUS *cut and carry with farming* are middle or small but in reality are even smaller because of the very steep parts and the very dry land. In a further study degraded land could be compared to non-degraded land also with the help of remote sensing. In the LUS *farming lowland* the difference in land sizes are immense; there are big land owners and small scale farmers. The property situations of the land in the middle zones are very diverse. Whether a farmer owns much land and is rich can be observed by the house size. Big landowners who live in the surroundings have very big houses. In the middle zone, especially in the LUS *farming lowland*, all the land can be used thanks to the flat relief.

The physical capital is on average the same in both zones.

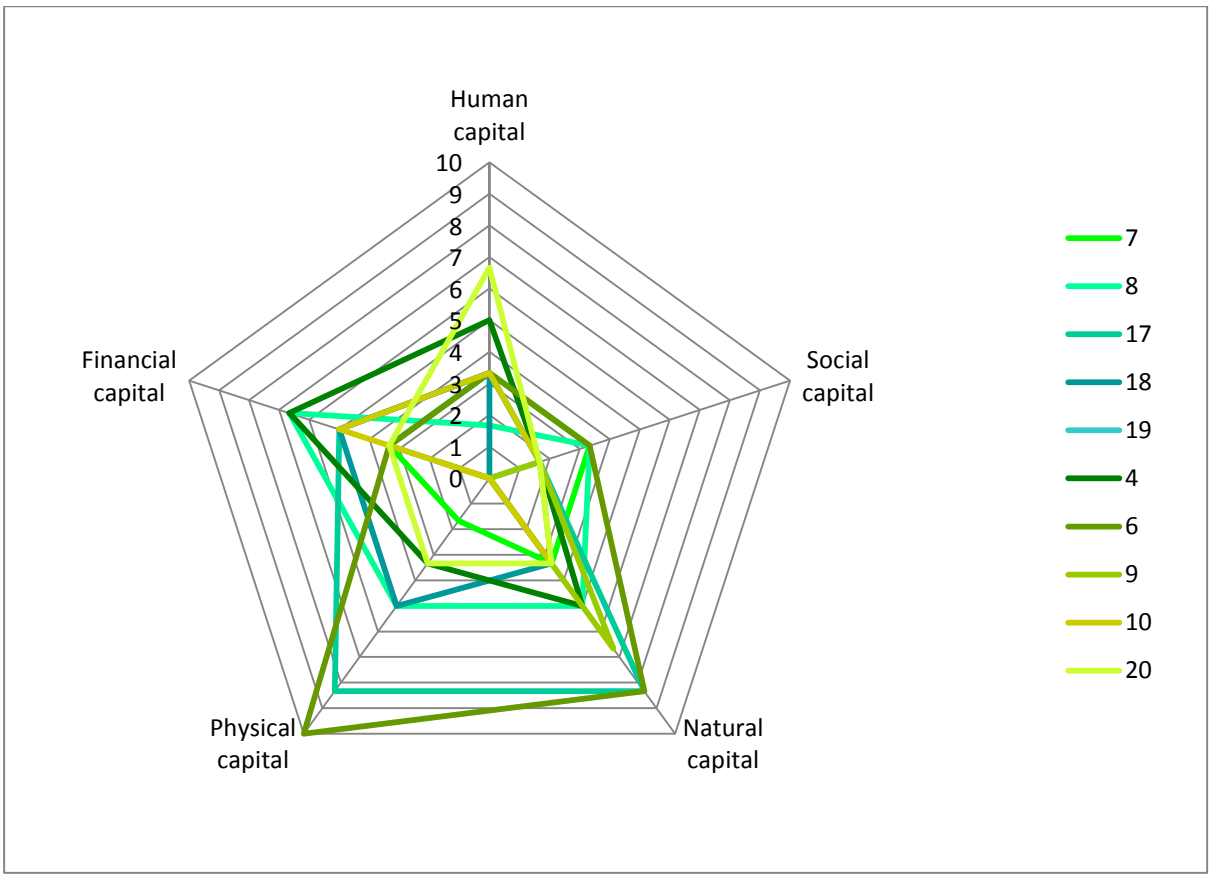
Also the average value of the financial capital seems to be higher in the upper zone, which is not supportive of the observation that the farmers in the middle zone are richer. The high financial capital in the upper zone can be explained by the huge governmental activities in this zone concerning SWC. The farmers are animated to conserve their soil through incentives because here

the biggest successes in reducing the sediment cargo are expected. The numbers of different financial sources are equal in both zones. This is mostly because the farmers of the LUS *agroforestry* are often engaged in other sectors than agriculture. Without this LUS the upper zone would be almost exclusively restricted to agriculture.

In general we can say that the range of the different capitals are much bigger in the upper zone than in the middle zone, where the farmer`s accessibilities to the different assets are more diverse. In the middle zone just the physical capital presents a big range; this is because the physical capital depends on the financial capital (if the farmer has financial resources to buy a car or a motorbike or not for example). However in the LUS *farming lowland*, in the middle zone, the property situations of the farmers are very different. There are a lot of landowners holding large fields, which employ farmers without own land to work on their fields.

To make more detailed statements about the assets in the different LUSs, a bigger sample would be necessary. However the identification to which LUS a farmer belongs to is difficult, because the fields of the farmers are located in different LUS. Some hypotheses on the basis of the samples are given:

1. In the LUS *cut and carry with farming*, social capital is determined by membership in a farmer group.
2. The average value of the financial capital in the LUS *farming lowland* is higher, because the farmers work in other sectors.
3. The average value of the natural capital in the LUS *agroforestry* is high, because of the big land sizes in this LUS.



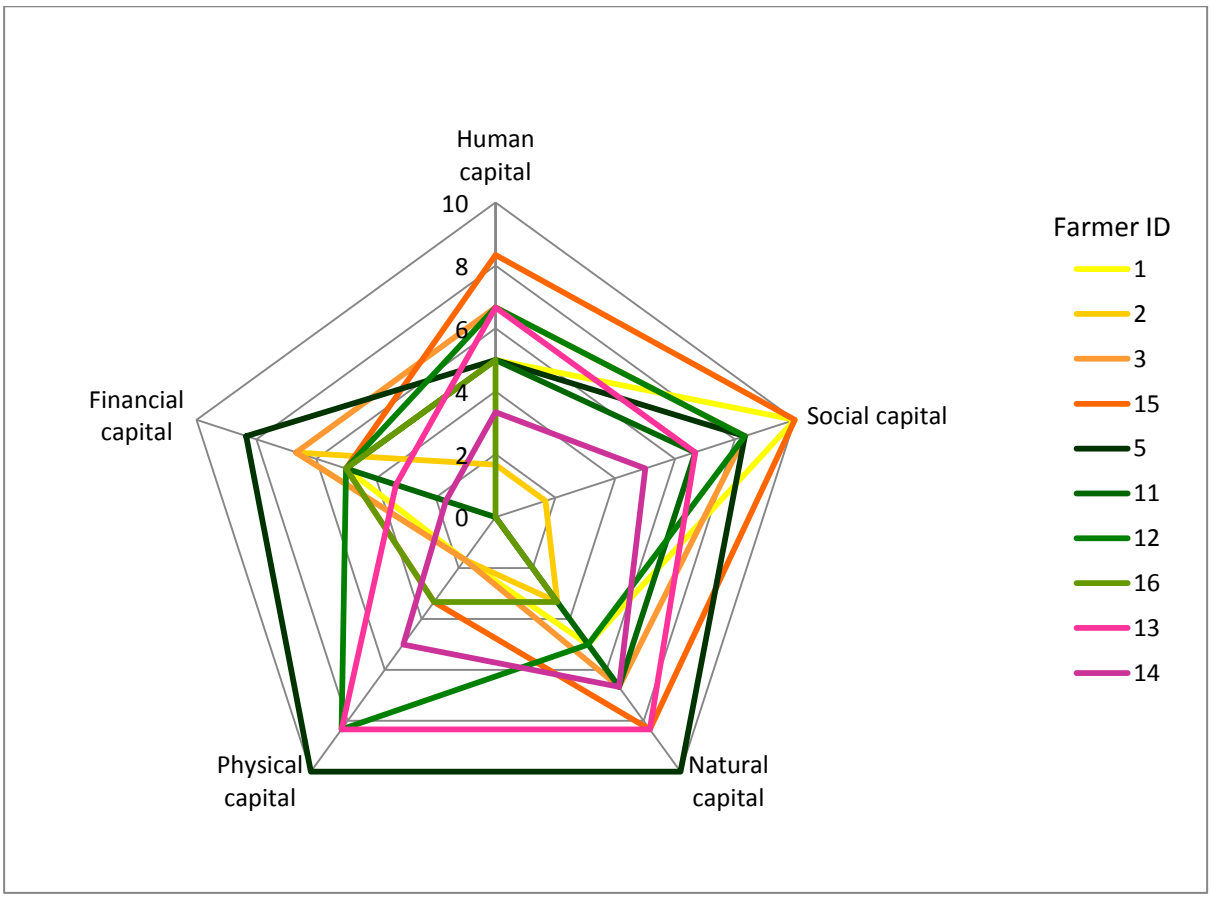
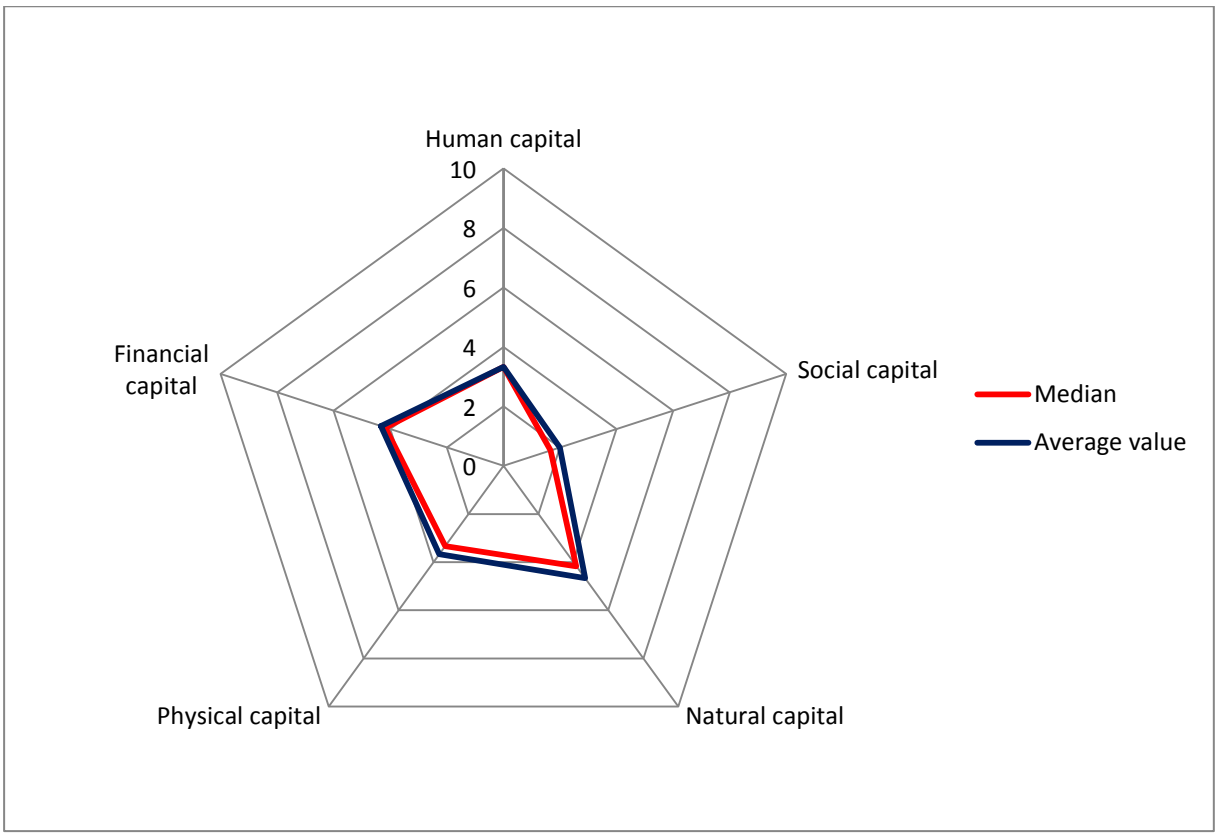


Figure 4.14: Distribution of the LH assets of the farmers in the middle zone (upper star diagram) and upper zone (lower star diagram). The different colours indicate the farmers ID.



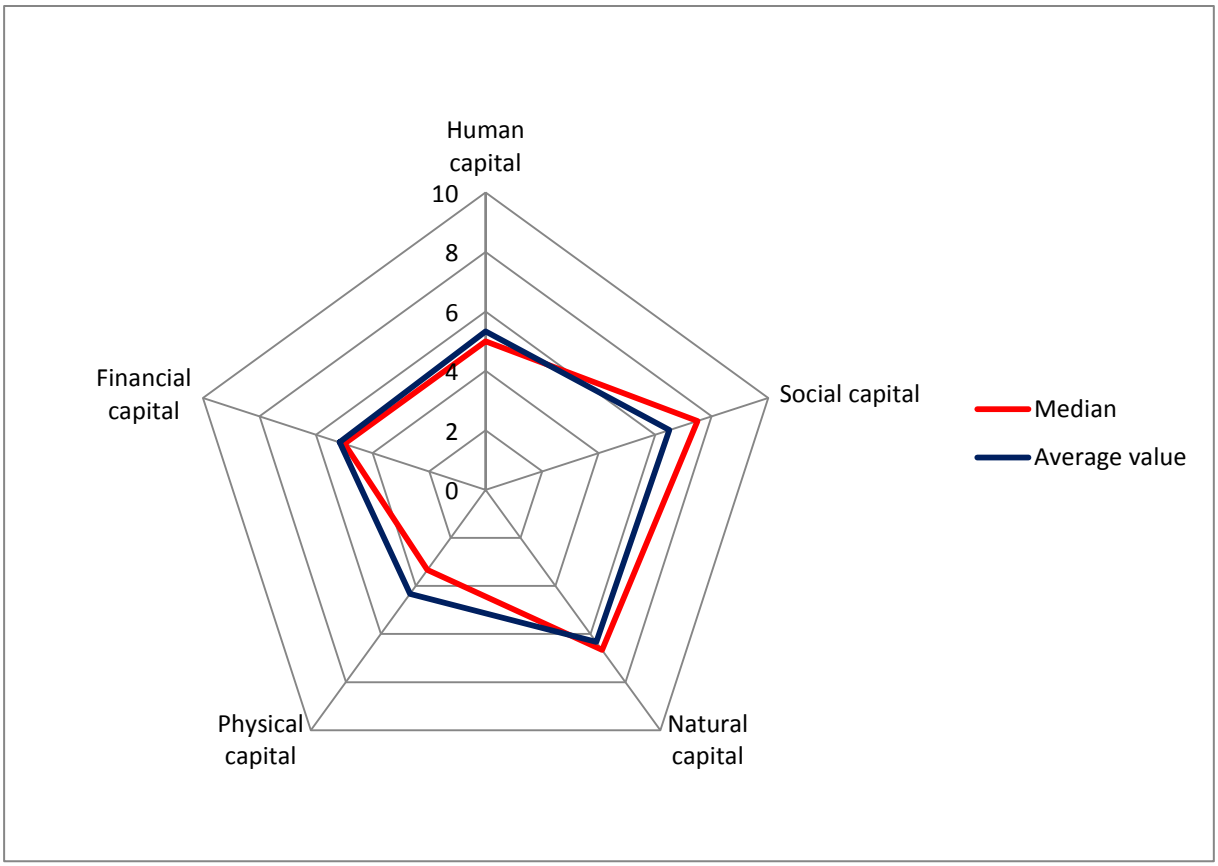


Figure 4.15: Median and Average value of the farmer`s livelihood assets in the middle zone (upper star diagram) and upper zone (lower star diagram). Obvious is that the values are higher in the upper zone and that the median and average values of the both zones are almost the same.

4.4.3 Transforming Structures & Processes

In the DFID framework, there is no precise list of transforming structures and processes. I decided to look at three key elements: the stakeholders and institutions acting in SWC, markets and other factors possibly influencing livelihoods and SWC. These elements were chosen due to reachable information.

Main Stakeholders and Institutions

In Figure 4.16 the main stakeholders and institutions concerning SWC are presented. This overview includes the institutions and actors found in the field. According to Figure 4.16, we can differentiate two different levels of political bodies (legislation). On the one hand we have the superior legislation of the Rebublic of Indonesia on the national level and on the other hand, on a regional level the provincal government of West Java located in Bandung.

The executive agency for soil and water conservation is the **Ministry of Forestry of Indonesia** coordinated from Jakarta. Our contact person Mr. Sayful Anwar is an employee of the Ministry of Forestry of Indonesia in Jakarta. Java is divided into different Watersheds and coordinated by the nearby branches of the Ministry of Forestry of Indonesia in the districts.
The Ministry of Forestry of Indonesia consists inter alia of the DG Watershed Management and Social Forest (BP DAS), the Center for Conservation and Natural Resources (BKSDA) and a Technical Implementation Unit (UPT). The BP DAS is responsible for the watersheds and the BKSDA to conserve the primary forest (maintaining the biodiversity and the environment). The UPT helps to implement the projects in the regions and is responsible for the coordination of the projects (SWC activities).
But every district also has its own **local Departement of Forestry (Dinas)** and an own Technical Implementation Unit (UPT), who are active regionally and locally in the fields. The extension workers are part of the UPT and are coordinated from here. Many activities relating to SWC are done by the Departement of Forestry of the regional government in Bandung and its Departement of Forestry. This is reflected by farmer interviews of my sample, in which they stated that the government of Indonesia is strongly involved in agriculture and organizes many projects and farmer field schools in terms of conservation agriculture. In the interviews of my sample, some farmers reported on the activities of the regional government in soil and water conservation but others did not. Some of the farmers were never even visited by an extension worker; these farmers were not participating in any farmer group. Many activities were also carried out to empower the small-scale farmers and to enhance their livelihood. The empowerment of the farmers is done through the formation of **farmer groups**. Farmers who are not participating in any farmer group do not have any information on good

practices in agriculture and especially about SWC technologies; the governmental programmes or information often only reaches the members of the farmers groups. The reason why farmers do not participate in farmers group is lack of time, and indirectly, poverty. If a farmer has to invest his whole time in agricultural production to generate enough food to survive, he obviously has no time to participate in a group. The number of children can also affect membership. Farmers with many children have more manpower and the work can be distributed among them, so the possibility to participate increases. In this case above all young farmers without children or small children are excluded from the farmer groups and therefore from information on SWC. Mainly young farmers need help in agricultural know-how, especially in SWC- because of lack of experience; it is therefore important to solve this membership problem. Financial support in form of a long time credit for the 'non-member' farmers could be a solution. According to MR. ANDÉ, Department of Forestry of Bandung (2010), the farmer organizations were set up to simplify the contact with the farmers and to help them with information or funds from the government. Leaders of a farmer group told me that they made a proposal to the government asking for financial support but instead received insufficient material support. The same farmer reported that they can consult the Department of Forestry in Bandung if they have any questions about the SWC and that they can get seeds from the regional government. Additionally, participating farmers are categorized as advanced farmers by society and government and their bargaining position will also increase. 'Non-member' farmers are disadvantaged in economic terms. They are excluded from help of the government and they are less reputable. It is important to build structures that also include the poor to ensure an equity-based innovation flow. Also, building joint forums for decision-making and action would be a very good opportunity to bring together existing interests and organizations. In the following the information chain regarding SWC will be described. The information is given in a workshop, a field course or by an extension worker in the field. Mostly the participants are the leaders of a farmer group and this leader further tells or demonstrates the new information to the members of his farmer group.

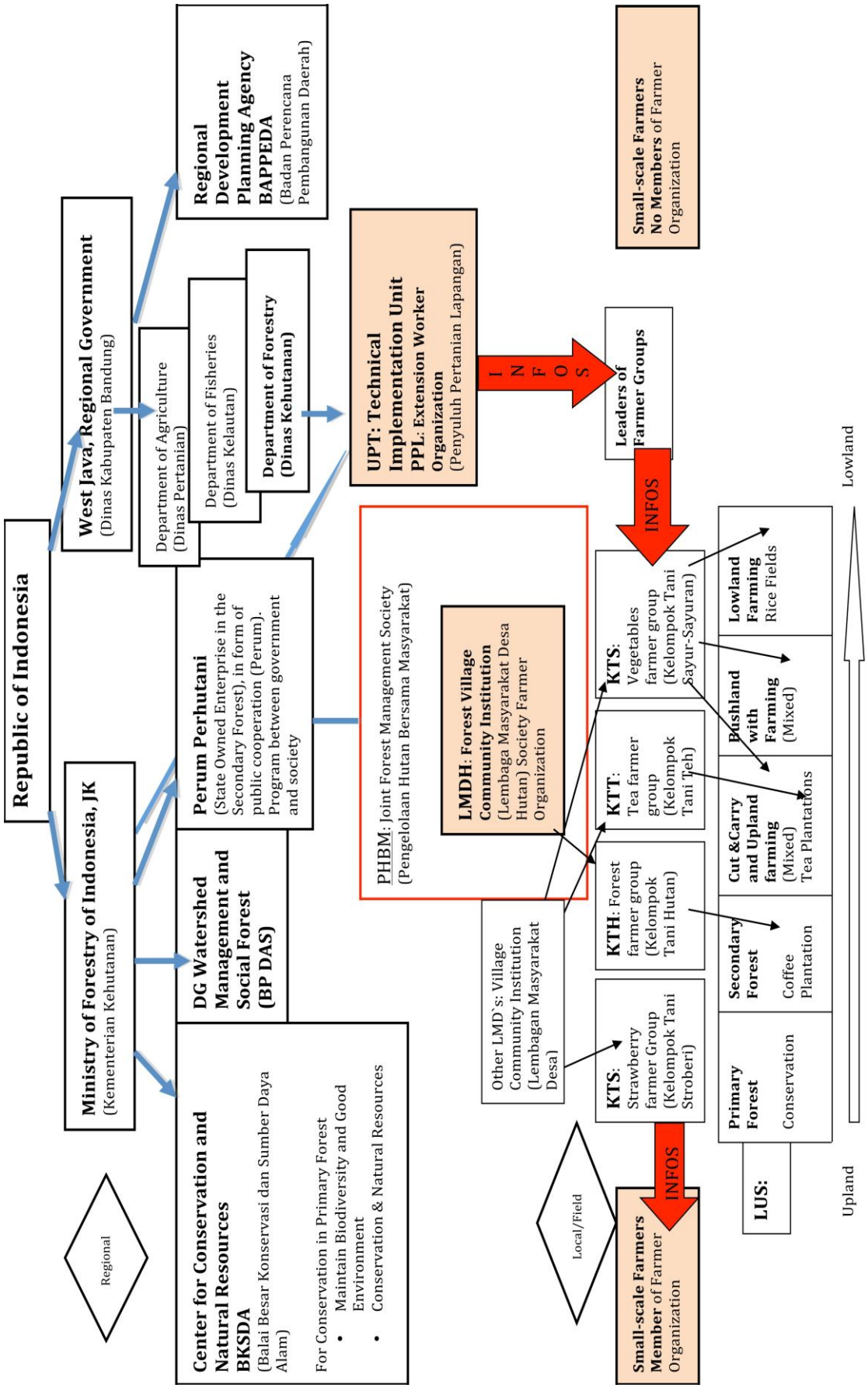


Figure 4.16: The main stakeholders in the field concerning soil and water conservation. The legislation on different administrative levels, the executives, parastratals and the farmer groups are illustrated. Self-composed and is not completing.

Other stakeholders concerning SWC are two **parastatals**: the Perhum Perhutani and the PTPN 8. Both of them are state-owned enterprises; Perhum Perhutnai is active in the secondary forest and the PTPN 8 in the tea plantation sector.

"Perhutani is a State-Owned Enterprise (BUMN) in the form of Public Corporation (Perum) whose role is managing forest resources in the islands of Java and Madura. The strategic role of Perhutani lies in its function in supporting environment sustainability, the socio-cultural and the economic system of forest communities" (PERHUM PERHUTANI 2011).

Parastatal company, Perhum Perhutani runs two projects with a focus on sustainability and on society. These two projects are labelled as corporate social responsibility: the 'Collaboration Forest Management System with the Community or Joint Forest Management (PHBM)' and the 'Partnership and Environment Mentoring Program (PKBL)'. The latter is coordinated by the Ministry of State-owned Enterprises of Indonesia (BUMN) and therefore I never got in contact with this programme. According to PERHUM PERHUTANI (2011), the PKBL aims to improve the capabilities of small businesspersons until they become strong and independent enough and to empower the social conditions of communities funded with BUMN`s profit share. For further information see the website. "Through PHBM, Perhutani, working together with forest village communities and other parties, undertakes joint forest management activities. The activities have been undertaken since 2001 as the continuation of the company's social programmes since Forest for People policy was enacted in 1978 in Indonesia. There are no less than 5,403 forest villages in Java and Madura islands existing around Perhutani's forest area. From 2005 to 2010, Perhutani has noted that there are 5,054 forest villages or 94 percent of the total of forest villages in Java and Madura islands working together through PHBM programmes" (PERHUM PERHUTANI 2011).

There are **Forest Village Community Institutions (LMDH`s**) and **forest farmer groups or cooperatives** (KTH) to empower the forest farmers and to help them to better defend their interests. Perhum Perhutani says that until now the PHBM programmes, according to the communities were successful.

PTPN 8 is based on the government regulation No 13 from the year 1996. The idea is to consolidate the function of the state-owned enterprises in the plantation sector into the national and economic development framework and to face global economic movements. The government, along with the Ministry of Agriculture applied the consolidation programme (PTPN 8 2011). Their vision and missions according to PTPN8 (2011) contain environmental awareness. Also the PTPN 8 has a very dominant role in the region, especially for the tea farmers. The farmers often sell their tea leaves to the company. One farmer reported that because of the delayed payment, he decided to sell the tea to another company. According to the same farmer the PTPN 8 sells the products abroad and does not have real competition in Indonesia. Also many farmers work in the state plantation as leave

pickers. They are coming from the nearby villages and are often the wives or daughters of a household.

Tea leaves cannot be sold on the traditional market and therefore farmers are dependent on companies and collectors.

In focus, Figure 4.16 shows that there is a lot of activity in terms of SWC in the area. Due to the mentioned information sources of the sample, we can assume that the activities of the different governmental institutions and the parastatal Perhum Perhutani are relatively successful. 10 of the 13 information sources mentioned by farmers are project/programme based and are somehow connected with the national or regional government. These information sources are very important in the learning process of SWC technologies for the farmers.

Due to the complexity and wide range of institutions and the effect of decentralization in 1998 (see Chapter 4.4.3.2), the coordination and cooperation between the institutions represents a huge challenge. For example, the fact that the Sub Watershed Ciwidey - where the study took place -is situated in the district Bandung and is coordinated by the Ministry of Forestry of Indonesia branch in Bogor and not by the nearer branch in Bandung, was very hindering for the whole study and made it more complicated.

Decentralisation and its Impacts on SWC

After the abdication of Soeharto 1998 the governmental system was decentralized. This event is still crucial for SWC. Today every district has its own power and decision-making bodies in SWC, with its own positive and negative effect; as shown by the following expert interviews and literature review:

According to **HARDJONO** (2005) of the Institute of Southeast Asian Studies of the Australian National University**,** the regional autonomy and the implication of decentralization for conservation of the land and water resources are frequently overlooked.

HARDJONO (2005) criticizes the non-functioning of the legislation in the local government and shows the main problems concerning decentralization. Environmental considerations still take second place to development. “Local government is showing no greater interest in the conservation of land and water resources than the national government did in the past” (HARDJONO 2005). He also mentions the complicated way in which legislation has been phased. Further, he mentions the corruption and the aspiration of maximum profit by the actors of the region. On the other hand he describes the increased critical observation of the public, like NGO`s and the media, concerning policy-making and procedures at a provincial and district level. This increased critical observation leads to better conditions in policy making.

Among other things, HARDJONO (2005) sees the transformation of arable land into building sites, as a reason for soil degradation in West Java (see Box 4.6). Based on this he brings up the importance of professional and genuine on-the-ground analyses of the potential environmental impact (*amdal*) of proposed investments, as well the openess of information. Further he emphasizes the need of immediate measures to preserve the natural environment and believes that the ongoing efforts to improve the environmental condition are hampered by the extent of the damage done before decentralization. This fact he states, makes it extremely difficult for today`s authorities to start enforcing regulations.

Box 4.6: Development policies in the sensitive uplands

1980 a decree to control the spread of built up areas on the slopes to the north of Bandung was developed. The decree conveys restrictions on development in the area of northern Bandung and prohibited the construction of houses and other buildings on steeply sloping land above the 750 meters contour and designed this area as a conservation area (more decrees and local regulation were made but they failed).

In 1996, the provincial government handled the granting of location permit for land development. "Developers were able to obtain an *ijin lokasi* (is an official claim to the land) for land that suited their purpose without having to consult the regional spatial plan (RTRW) of the province or district or any other land use regulations. The developers acquired the *ijin lokasi* from local people at a low cost. Government authorities also issued permits without any reference to environmental implications. Before making an application for an building permit (*ijin mendirikan bangunan*) the developer had to prepare an environmental impact analysis (*amdal*) as written in national level legislation, but submission and approval of the *amdal* was little more than formality.

Despite the transfer of responsibility for the granting of *ijin lokasi* to the district- level government in 1996 the system has not changed and still makes it possible for developers to ignore local environmental conditions. Today 85 development companies hold *ijin lokasi* for almost 4000 hectares of land on steep slopes in Northern Bandung. According to the district-level Regional Development Planning Board, the district government has given permits to only 15 of these companies which control less than 10 percent of the land. The other 70 obtained it from the provincial government 1991-1996, despite a provincial level decree issued in 1994 stating that no more *ijin lokasi* were to be given for any part of Northern Bandung". (Hardjono)

Given these practices, decentralization is not very positive for the conservation of nature in the districts.

(HADJONO 2005, Researcher of the Institute of the Southeast Asian Studies)

Experts View of SWC Programmes, Activities and Future

According to the expert interview with **MR. SYAIFUL ANWAR**, Ministry of Forestry of Indonesia (2010), a negative effect of decentralization is, that the independent districts are often unable to perform their functions. Also the corruption in the regional and local government is a problem, he says. On the other hand he evaluates the closeness of the services to the people as positive. At the moment Mr. Syaiful Anwar and the Ministry of Forestry of Indonesia are trying to convince the national Parliament (Government) of Indonesia to ratify their proposal of an Integrated Watershed Plan. It contains new laws about soil conservation. But the proposal has not been accepted yet. He says that regulations about water already exist but it is important to regulate water and soil together. By governmental law the Ministry of Forestry of Indonesia has to maintain the carrying capacity of the watershed. One part of the Integrated Watershed Plan is an Action Plan on SWC. MR. SYAIFUL ANWAR, Ministry of Forestry of Indonesia (2010) emphasizes the importance of the cooperation of all ministries. This Integrated Watershed Plan can also be seen as a spatial planning or management plan, he says. Further MR. SYAIFUL ANWAR, Ministry of Forestry of Indonesia (2010) criticizes the profit-oriented understanding of SWC by the Ministry of Agriculture. The Action Plan of SWC regulates irrigation, the domestic use of water and soil and the energy supply of the Citarum Watershed. According to MR. SYAIFUL ANWAR, Ministry of Forestry of Indonesia (2010) and many other experts poverty reduction is very crucial to prevent further soil and water degradation. There exists a law, which allows the cutting of trees for housing purposes. MR. SYAIFUL ANWAR, Ministry of Forestry of Indonesia (2010) stated that the problem of this law is that businessmen ask the economically weak people to cut trees for them for money. If poverty could be reduced the willingness to cut trees and destroy their own livelihood would be much lower. Here we can recognize a direct link between SWC and poverty. It seems to be obvious that poverty reduction also can increase SWC. In the mentioned case, the willingness and need of the farmers to cut trees can be reduced and the vegetation cover obtained by poverty reduction.

According to **MR. ANDÉ**, Department of Forestry of Bandung (2010), in Ciwidey 2,000 ha of land is critically affected by erosion. To rehabilitate and stop the extent of critical land the Program for Critical Land (GRLK) was developed and implemented between 2003 and 2009. During this period 1.93 million trees were planted (1ha= 400 plants => 4,825 ha).In this programme the farmer could still sell forestry products (timber, pine oil, fodder) but only after the trees were five years old. This SWC programme was based on business models because if the programmes do not include a commercial element the farmers often have no interest to participate. The government also gave the farmers animals (goat and sheep), silkworms, honey bees and mushrooms as alternatives to timber production. These alternatives are sustainable and environmentally compatible. The regional

Department of Forestry also has other projects like the Participatory Rural Appraisal, where the department organizes farmer meetings and specific problems can be discussed and solutions found. Further MR. ANDÉ, Department of Forestry of Bandung (2010) mentioned that farmers are not allowed to use 'dead land' as they wish but have to follow the governmental recommendations for its use.

MR. NAIK SINUKABAN, University of Agriculture in Bogor (2010) says that it is important to pay the farmers compensations for introducing SWC technologies because they are often afraid to introduce something new as it could affect their production negatively. Compensation constitutes a guarantee for the farmers and strengthens their willingness to introduce new technologies. After a while the farmers are used to the new technology and compensation is not necessary any more.

International Collaborations and Projects Concerning SWC

Beside all these activities of national and regional institutions there are also international collaborations and projects concerning SWC and sustainability. In the following the most important ones are listed:

- Progressive in terms of nature conservation is the Environmental Services Program (ESP) of the USAID. "The Environmental Services Program (ESP) is a five-year programme, developed by USAID/Indonesia in response to the Presidential Initiative of 2002 to improve sustainable management of water resources. This initiative supports activities in the following three key areas: access to clean water and sanitation services; improved watershed management; and increasing the productivity of water" (IRC 2011). On the web of IRC is an extensive report on this programme in Indonesian and includes the lessons learned, the effects of water degradation, water conservation techniques, etc.
- The concept of High Conservation Value Forest (HCVF) was initiated in 1999 by Forest Stewardship Council and was included in Principle 9 of Sustainable Forest Management Standard. The first version of identification, management, and monitoring guide was made in August 2003 by ProForest and SmartWood and then revised in 2008 by Indonesia High Conservation Value consortium consisting of TNC, WWF, Tropen Bosch, Deameter, Rainforest Alliance, FFI. The revision produced the Guide on High Conservation Value Areas Identification in Indonesia currently referred to by forest management and other institutions in the framework of forest sustainability implementation." "Perhutani is committed to support the application of HCVF at local, national, and global

level. In several areas, Perhutani works together with Tropical Forest Trust (TFT), an international NGO, to identify, classify, and make plans to preserve the area, socio-culture, and environment bearing high conservation values."

- In May 2010 Norway and Indonesia founded the 'Norway- Indonesia REDD + Partnership' to reduce emissions from deforestation and forest degradation. In October 2009, the president of Indonesia committed the country to reduce its CO_2 emissions by 26 percent until 2020. To support the largest absolute reduction commitment ever made by a developing country, Norway wants to support Indonesia in reaching its target with up to 1 billion US dollars.

Market

Further the market structures are discussed. Three different ways of how the farmers sell their products are found in the region. First, the farmers can sell their products to consumers on the farm (direct selling), second, they can sell their products on the traditional market, and third, they can sell their products to collectors. To sell the products on the farm is the best possibility, as there are no transportation costs and the price can be determined. If a farmer sells his products on the traditional market he has costs for transportation but prices also can be discussed and determined by the farmers. On the traditional market the farmer finds a great demand. There are different challenges for farmers who cannot go to the traditional markets to sell their products. The main reason why they are not able to go is the lack of physical capital (motorbike/ car), or transportation costs they cannot pay. To nevertheless bring and sell their products on the traditional market, some farmers give them to wealthier farmers, who bring them to the traditional markets. In this case the farmer has to trust the other farmer. Some farmers told me that some of these sellers were not honest with them and therefore, they do not use this possibility anymore. Selling the products to the collectors saves the transportation costs and they are not dependent on the local market, but the prices are made by the collectors and cannot be discussed. To sell products to a collector is a wide spread option but the opinions about it are divided. Some farmers report that they are not satisfied with the prices of the collector and that they cannot discuss it with them. The farmers do not have any market information and this makes it possible for the collectors to exploit the farmers. A solution would be that the farmers could get information on the current market prices from the farmer groups. But there are also farmers who are satisfied with the prices; one farmer even commented that the prices are regulated by the world market.

The market structures can be differed by product. They are very distinct and determine how the farmers sell their products. Coffee beans and tea leaves are always sold to a collector because the end product cannot be produced by the small scale farmers or the farmer groups. Sometimes

strawberries are also collected by a collector and brought to bigger markets or are sold directly on the farm and used for promotion of tourism in the area. Collecting strawberries is a popular tourism activity. There are also smaller and bigger collectors for vegetables and fruits.

Access to the market also allows farmers to buy utensils needed for SWC implementation like stones, seedlings or tools. A project to bring the utensils, especially tools to farmers without market access would be useful. According to my observations and interviews, farmers without market access are mostly located in the upper zone. The seedlings are often sold directly on the farm (Memet and other farmers) and some stones can be found in the vicinity. To implement SWC technologies sustainably, especially if management and agronomic measures should be implemented, it is necessary to involve the collectors as well, because they react to demand and therefore define which plants are planted. The demand of the collectors is controlled by the regional markets and customers' demands and even by the demand of the world market. In the world market the labelling of products from sustainable agriculture represents a good solution. By labelling the products from sustainable agriculture, SWC can be promoted. Access to the traditional market also means that farmers have access to information and innovation. Some farmers get the seedlings directly from the collector, mostly the commercially oriented and large scale farmers.

A good access to traditional markets and the participation of the farmers to determine the prices will increase farmers' livelihoods and the willingness to implement SWC technologies, because richer farmers can defer risks.

Rules, Regulations and Recommendations with an Impact on SWC

Some famers told me about agricultural rules (to plant the *maesopsis, surian*, Eucalyptus and Pinus tree by law and how to use fertilizer). Other farmers report that there are no rules concerning the agriculture but that of the department of Forestry and Agriculture (for example a plantation timetable) exist. The farmers often did not know if the instruction was a rule or a recommendation was, but mostly there were no rules mentioned. Except the rule made in 2006, which implied that no vegetable can be planted in the secondary forest, was named by all of the coffee farmers in the secondary forest. One farmer reported that for this change the farmer organizations tried to facilitate the purchase of seedling by giving credits to the farmers. Many farmers are still indebted because of this change in land use.

A farmer`s day is strictly regulated by the Islamic practices and rules. Breaks for the mandatory prayers are always taken. All the farmers of the sample mentioned a high acceptance of the SWC technologies. Also, the helpfulness is a pushing factor for the implementation of SWC technologies because the farmers help each other to adopt them and the manpower can be shared.

Ramadan, on the other hand also has a significant effect in the agricultural work. During Ramadan the agricultural activities are reduced to the morning due to the shrinking energy of the farmers as the day proceeds. It is important to say that environmental training and field courses should not be held during this period of fasting.

4.4.4 Livelihood Strategies

According to DFID (1999), access to different levels and combinations of assets is probably the major influence on their choice of livelihood strategies; a good endowment with assets leads to more positive livelihood choices. Further, good transforming structures and processes can reinforce positive choices; if they function well; they will facilitate mobility in the labour market, reduce risks and transaction costs of embarking on new ventures and can increase the efficiency of investments. On the other hand the farmers have to make negative choices (…) or may have no choices at all. A look at my study area shows the following:

According to my observations, most of the farmers in the **middle zone** are richer than in the upper zone, judging alone by the field and house sizes. In this zone we find farmers with an exclusive commercial market orientation. Products are sold to supermarkets in Jakarta or even collected and exported. The big landowners partially live in nearby Bandung and never work in their fields themselves, but hire farmers from nearby villages. Some of the land owners also let their fields to others. The hired field workers only follow the instructions of the field owner. This fact often leads to wrong agricultural decisions and non-sustainable land management due to the missing direct contact and observation of changes of their fields. In this zone mostly intensive agriculture is found, the owners want to get the biggest profit out of the land as an additional income source. Whether the land owner also works in the fields or controls them ma play therefore an important role concerning degradation. It seems as if the willingness for investments in SWC is higher if the land is in private tenure and if the owners themselves work in their fields. Farmers who are working in other farmers` fields in the middle zone often do not have their own land or only very small plots. Farmer number 19 for example owned a very small piece of land in the secondary forest, where the pressure on small fields is high and the soils are often overused. These farmers are also often forced to plant illegal vegetables in the secondary forest which is very risky because of the implying bad vegetation cover.
Before, many farmers of my sample in the middle zone were working in other sectors than agriculture. For example, they worked for a TV channel or as an architect. These farmers seem to be more connected and oriented to nearby Bandung or even Jakarta than the farmers in the upper region. In the middle zone farmers get more financial support from the family or get remittances

from a family member because many of them go to Bandung or even to the capital Jakarta to work. The middle zone has more relations to the city than the upper zone.

The market orientation of the farmers in the **upper zone** is subsistence. The farmers own their land (private tenure) and live off its products. They often go to work in other farmers` fields if their own production is not sufficient. This opportunity seems to be very popular in the region and especially in the LUS *cut and carry with farming*. This opportunity is used invariably by poor farmers. In the upper zone the farmers are also more dependent on family support (see Chapter 4.4.2).
All farmers of the upper zone work exclusively in their fields or in other farmers fields- they are only active in agriculture. The product variation in the upper zone is very diverse. Rice is produced for self-consumption. The vegetables are often sold to the traditional market or to the collector by farmers without transportation. In the upper zones the milk production for self-consumption is also a very important as a source of protein. Many of the farmers have one or two cows. We can assume that subsistence orientation in the upper zone is important also due of the distance of the nearby markets.

5 Synthesis: What are Links between Livelihoods and SWC at the Household Level?

In the last step I tried to analyse the links between the DFID livelihood framework, the soil and water conservation and WOCAT. In this chapter the hypothesis and assumption mentioned in Chapter 1.3 are discussed.

First the DFID assets (five capitals) were confronted with the number of SWC technologies used by the farmers. For each DFID capital (see Chapter 2.1.3) the correlation between the capital values (y-value) of the farmers and their amount of used SWC technologies (x-values) was calculated. They were presented in diagrams (see Appendix 2). The analyses showed no correlation or very low ones (see Appendix 2). A high amount of each of the five capitals does not correlate with a higher number of SWC technologies use by the farmer. Further the question was, if farmers with higher total asset values use higher number of SWC technologies. Again here, no correlation was found between the sum of all the capitals and the number of SWC technologies used. The hypothesis could not be proven.

The problem or additional question concerning this analysis is the assumption, that using more SWC technologies is better. This is a simplification and is not true in every situation, but in general a higher number and variation of SWC technologies is in most cases better than no conservation.

Further due to the fact the farmers did not mention a specific SWC technology but were often talking about SWC technologies in general, it was not possible to choose the existence of terraces as determining factor. Hence the possibility to investigate the capital values concerning the existence of terraces or not was not possible.

Also the comparison between the two groups 'adoption' and 'non-adoption' of SWC technologies was not possible, because every farmer in this region uses at least one SWC technology, in itself a very positive finding.

In a second analysis, the correlation between the values of the five capitals and the amount of information sources of each farmer were analysed. For this analysis I used the assumption that more information sources on SWC technologies leads to a higher and more conscious application of these technologies and further to more sustainable agriculture and less soil degradation and a sustainably used ecosystem. The analysis shows that the correlation between the different capital values and the number of different information sources are stronger in general than in comparison to the correlation between the capital values and the number of SWC technologies used. In the second

comparison, no significant correlations were found except in the case of the human and social capital. The Pearsons correlation coefficient *r* of the social capital amounts to 0.5265 and the one of the human capital 0.42035. Both values are over the critic value (0.378) of the correlation coefficient r with the security of five percent. Here I conclude that **farmers with a higher human and social capital also have more information sources about SWC.**

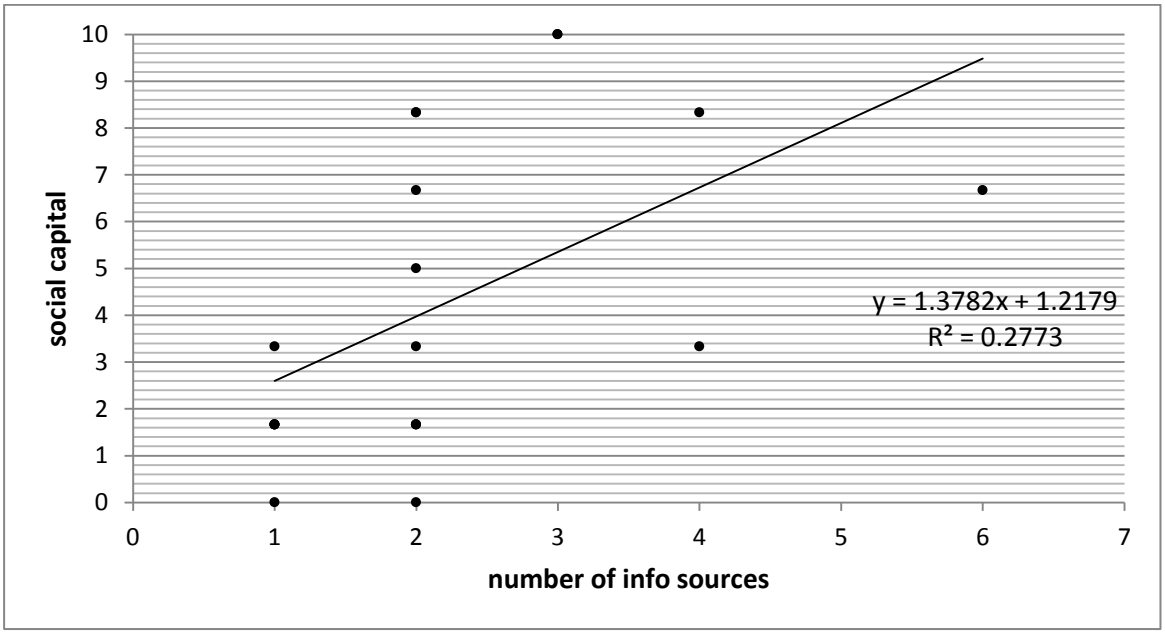


Figure 5.1: Social capital. The correlation of the farmers` social capital with the number of information sources. Shown is also the trend line.

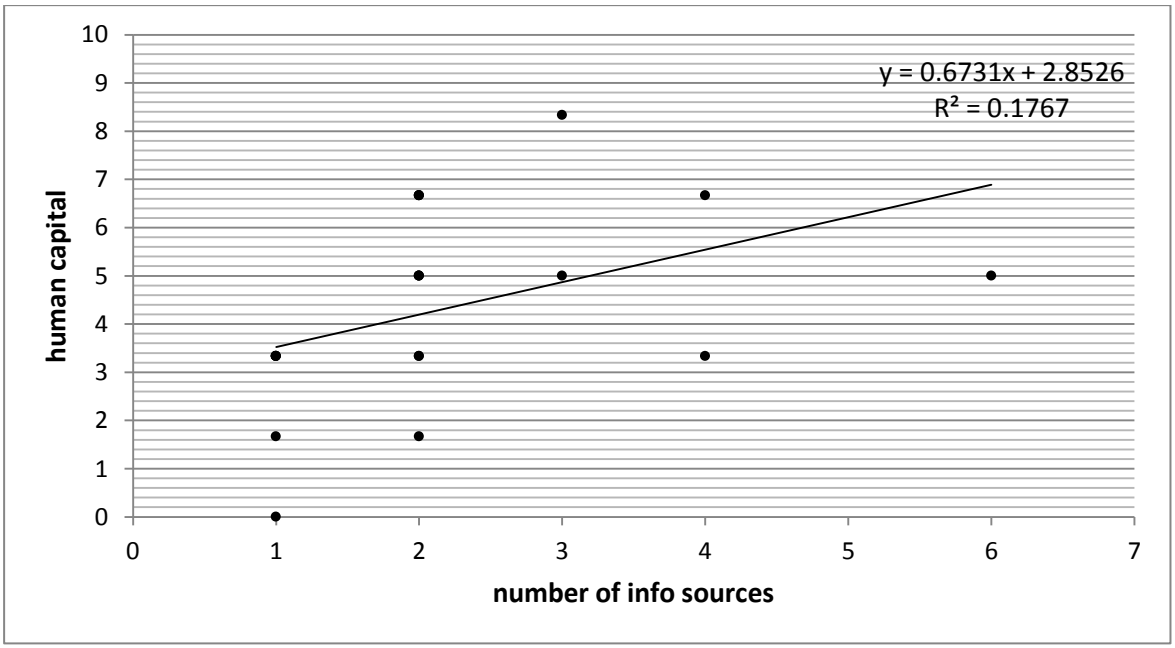


Figure 5.2: Human capital. The correlation of the farmers` human capital with the number of information sources. Shown is also the trend line.

There is a very weak correlation between the total asset values of the farmers and the number of information sources. The Persons correlation coefficient amounts to 0.414487 and also is over the

critical value, a correlation is also found. **Farmers with higher total asset values also display a higher number of information sources.**

Hypothesis number 2 could partly be proven- if a farmer has a higher human and social capital value as well a higher total asset value, also shows more information sources.

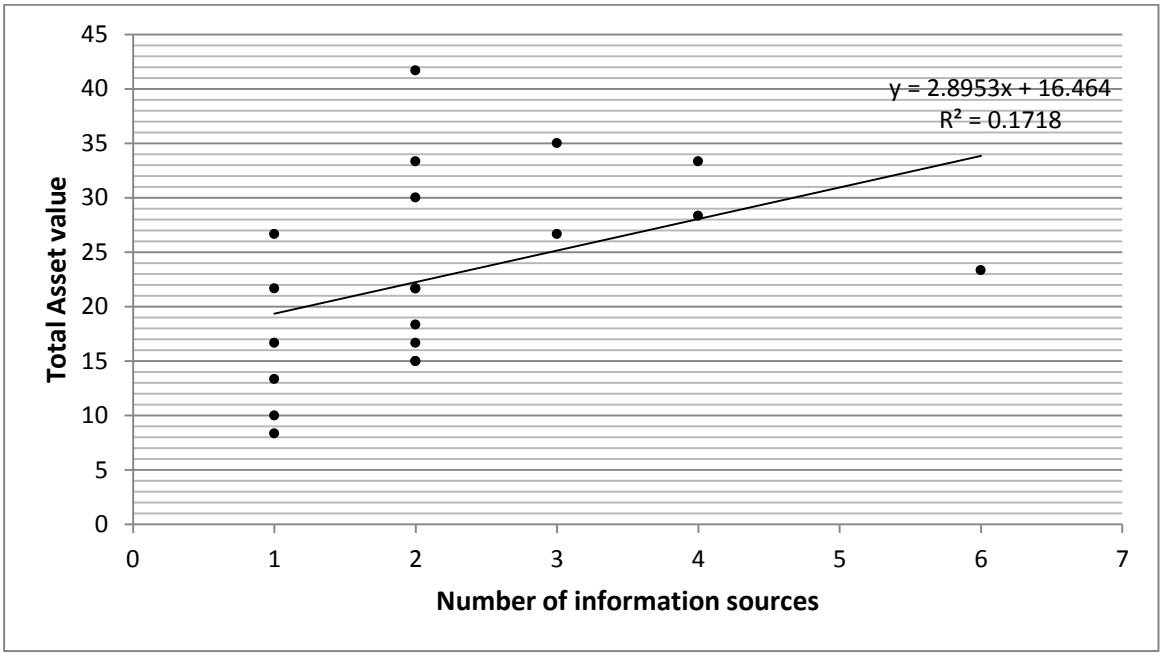


Figure 5.3: Total Assets by farmers. The sum of the capitals or the total assets in relation to the number of information sources.

As said before this second analysis was made in the scope of the assumption number 2 (see Chapter 1.4), a higher amount of information sources conducts to a higher number of SWC technologies used in a farmer's field. This is a further hypothesis and can be examined in a further study.

In a last step I also put some individual indicators of the capitals (see Table 4.4) of the farmers to their number of SWC technologies. The selected indicators are the household size, the amount of certificates, the membership of a farmer organization, the land tenure and the family size. There are no correlations found in the analysis.

All the other Figures of this synthesis are presented in the Appendix 2 and 3.

6 Conclusions and Recommendations

SWC technologies: In the research area many different SWC technologies are found, - it presents a largely conserved landscape. All farmers have at least one up to seven different SWC technologies.

Information sources: The range of SWC information sources is very broad. The farmers get information about SWC from their parents or even from the television. Tradition as information source is very important and seems to be the basis for the understanding of SWC technologies. Most information in the research area is 'cultural heritage' and is passed on by the family and culture. It is important to preserve this traditional information and to combine and extend them with information about new SWC technologies. The first step is to document this indigenous knowledge about SWC technologies. I did this as a first step of my research within the WOCAT network.

Farmers' expectations toward SWC: Farmers first expect SWC to prevent soil erosion. This is not self-evident and leads to the assumption that the farmers are well informed about the idea of SWC. This result, on the other hand, can be biased by the fact that the farmers knew that I came to do research on soil erosion and told me what they thought I wanted to hear. The second, most often mentioned expectation relating to SWC was to increase production. A good promotion of SWC is already present and SWC projects or programmes can focus directly on the SWC technologies without an introduction to SWC.

Farmers' perception of SWC: SWC is perceived and valued as positive by the farmers. The farmers mentioned a lot more advantages than disadvantages of the SWC technologies. The most important advantages of SWC are increased soil fertility; a bigger harvest; and decreased erosion. The disadvantage mentioned is the harvest decrease but this was only mentioned by three farmers out of 20. According to the farmers the most limiting factor in terms of practicing SWC is money. This result leads us to the assumption that farmers have to be supported with external inputs and therefore is in line with the statement of ADININGSIH and SYARIFUDDIN KARAMA (1992). They see the lack of sufficient production factors such as quality seeds and credit as one of the most common problems encountered in upland farming on Java. Through material and financial support by the government SWC could be enhanced, especially in upland farming (upper zones). Especially in the LUS *cut and carry with farming*, government support concerning SWC is needed. According to PALTE (1989) since the early 19th century the farmers started to occupy the upland due to population increase and until today the farmers are forced into the uplands due to population pressure. According to ANDININGSIH AND SYARIFUDDIN KARAMA (1992) the intensification in the rainfed uplands has begun only recently which means that we have to support the farmers in agricultural production and the implementation of SWC technologies. Additionally due to the deforestation, the ecological conditions are changing and heavy rainfall and erosion has increased (DONNER 1987).

Diversity: My research area shows a very wide range of land use systems, products, market orientations and land tenure. Also, the activities and household strategies of the farmers are very diverse. They are acting in different LUSs, are producing many products and are active in other sectors than agriculture for example tourism. But there are important differences between the upper and the middle zone according to livelihoods, LUS and SWC technologies used. So programmes or projects for SWC technology implementation should consider these differences for a better result.

Governmental activities: There are many efforts made by the government in terms of SWC, such as for example farmer field schools, workshops for farmers, agricultural days and other programmes. Whereas in the past, spatial planning was done at a national level, today, after the decentralization in 1998, the local government at village level adopts the attitude that they have the full right to decide how land in their respective area is to be used (HARDJONO 2005). Due to this fact, today there is an institutional chaos. To adjust and coordinate all these institutions and activities in terms of SWC at the local, regional and national level, will be a huge challenge. The coordination of these institutions would prevent duplication and SWC activities would be more effective.

SWC information spread: Information about SWC by workshops, farmer field school etc. should be more widely spread among the farmers and should be more inclusive. It is important that information about SWC is given not just to the leaders or the members of the farmer organizations, because poor farmers cannot participate in these organizations due to lack of time. These farmers could obtain financial support from the state for the time invested in participating in farmer organizations for example. Overall SWC activities should be done in the upper zone because this is the most affected and endangered area regarding soil degradation according to MR. SYAIFUL ANWAR, Ministry of Forestry of Indonesia (2010). The farmers in the upper zone are more subsistence and rely more on agriculture. As well the upper zone presents more steep slopes and is more affected by heavy rainfall.

Links between SWC and livelihoods: The livelihoods of the individual farmers show hardly any direct links to their SWC practices but a few are to be found. According to the results of the analyses, farmers with less family members, smaller households, without membership in a farmer organization, or with elderly persons, are factors that influence the access to information negatively. So it is important to focus especially on households, which present these characteristics.

Further studies: This pilot study provides a lot of material and information for deeper study. On the basis of the generated information my questionnaire could be extended to specific questions concerning the application of SWC technologies. The pressure on the agricultural lands in Indonesia and especially on the island Java will be even greater in the future and danger of soil erosion will increase. Due to this fact, more coordinated activities to implement SWC technologies as well as research should be made in the Upper Citarum Watershed.

Poverty and SWC: According to MR. ANDÉ, Department of Forestry of Bandung (2010), through poverty reduction the ecological conditions and SWC can be enhanced due to the fact that the willingness of the people to cut trees to sell them to business man is reduced or almost eliminated. So activities concerning poverty reduction in this region could have a positive effect on the preservation of the vegetation cover in the secondary forest.

Ramadan: Due to the fact of the strict adherence of the Islamic rules, environmental training, workshops and farmer field courses should not take place during the period of fasting due to the reduced energy of the farmers.

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MR. NAIK SINUKABAN, University of Agriculture in Bogor. 2010. Expert interview on 20 July 2010 in Jakarta.

MR. MEMET EYANG, Key farmer and NGO holder. 2010. Expert interview on 6 August 2010 in Ciwidey.

Appendices

A.1: Guideline of the Interviews

SOCIAL STATISTIC INFORMATION:
Farmer ID:
Position of resource person:
Name:
Age:

FIELD INFORMATION:

Field condition:

Land rights (Where what LUS):

Hole Field size:

SWC technologies:

Production Information:

IMPLEMENTATION OF SWC TECHNOLOGIES:

Date of Implementation:

From where, whom do you know about the SWC technology:

Why:

How:

Costs:

Rewards for CT (Incentives):

Motivation:

Adoption/ Innovation:

Information System (rating):

ASSETS CONTEXT:

Limiting Factors:

Food availability:

VULNERABILITY CONTEXT:
Shock/ Event:

Seasonality:

Trends:
TRANSFORMING STRUCTURES AND PROCESSES CONTEXT:

Member of Organization/ Cooperation or Community:

Government in Agriculture:

Rules:

NGO, Organizations:

Market:

LIVELIHOOD STRATEGIES:

Daily course:

Gender:

Combination of HH activities (off-farm activities):

Products for sell:

Family size:

Family support:

Labor availability (Migration…):

HH- size:

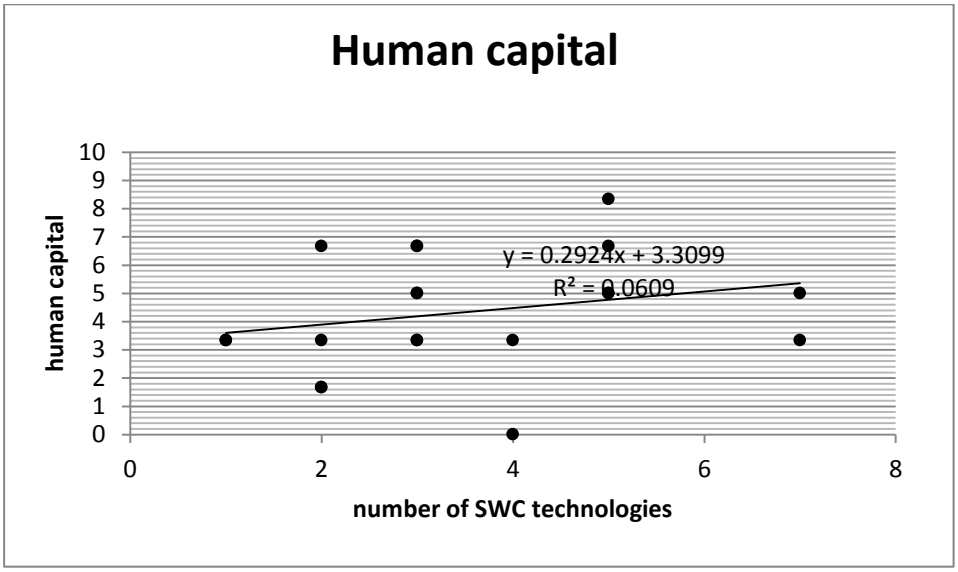
Livestock size:

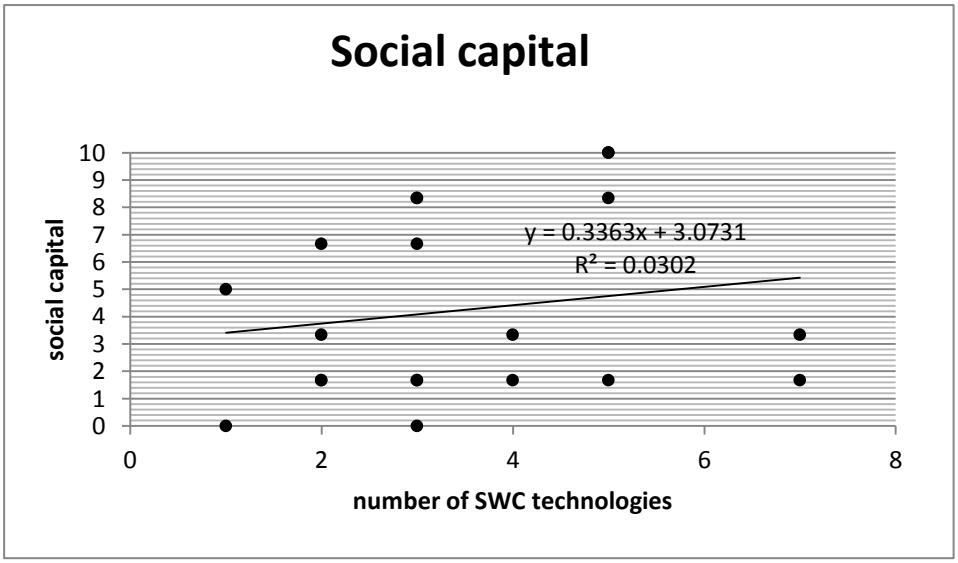
LIVELIHOOD OUTCOMES:
Expectations:

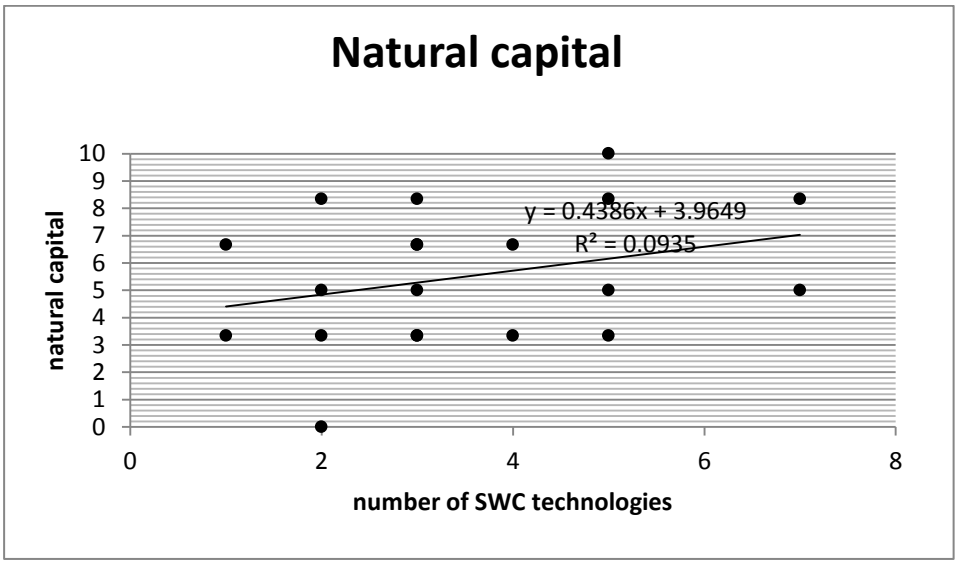
Real CT Outcomes:

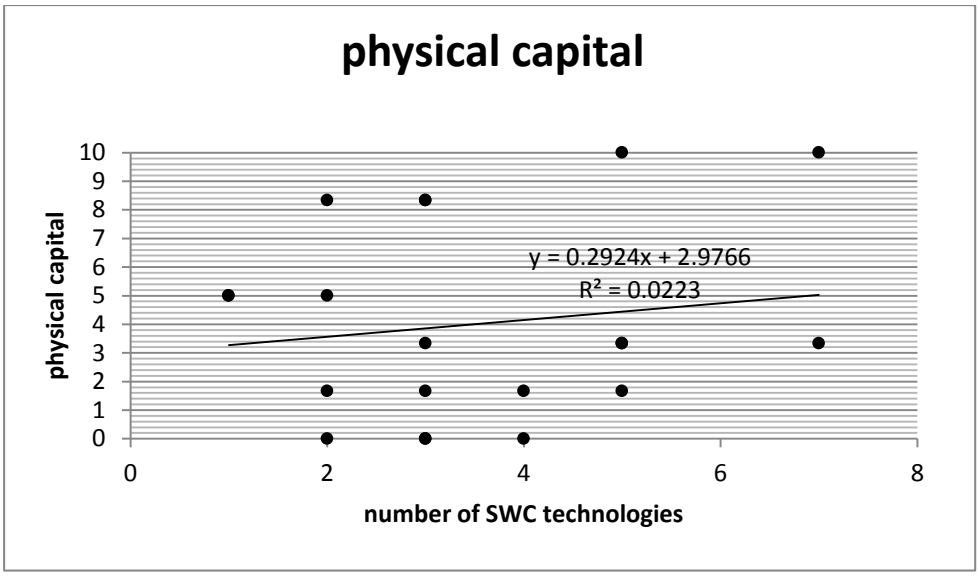
Social Acceptance of CT:

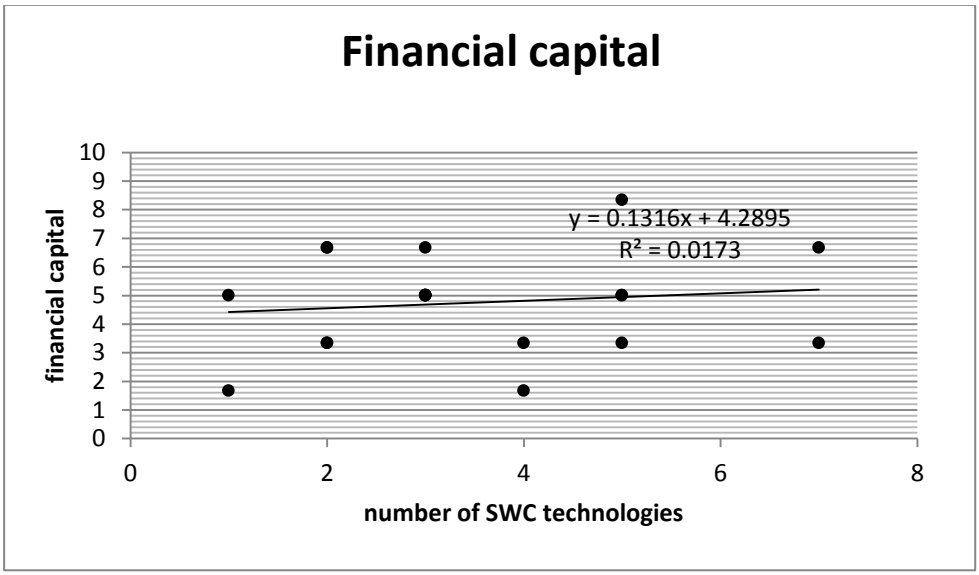
A.2: Number of SWC technologies in relation with the farmers assets

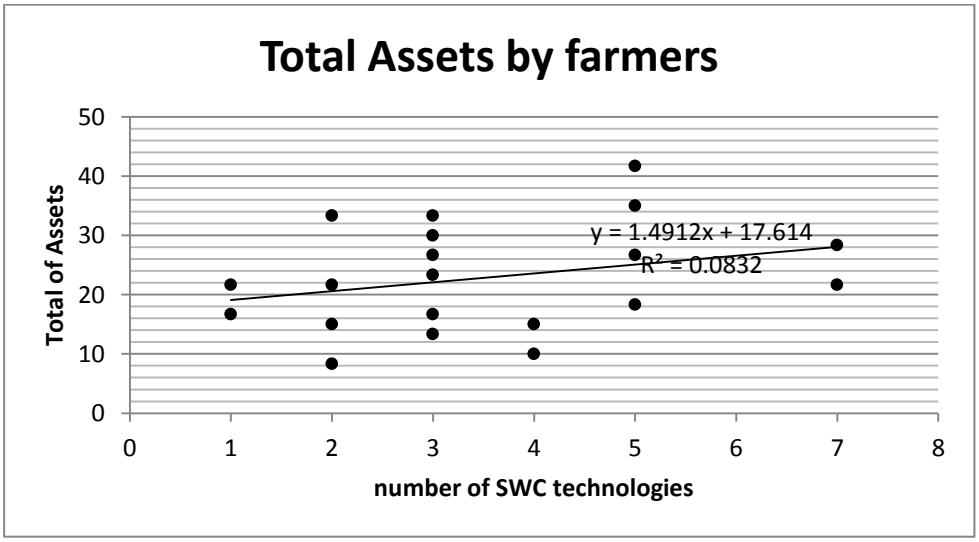




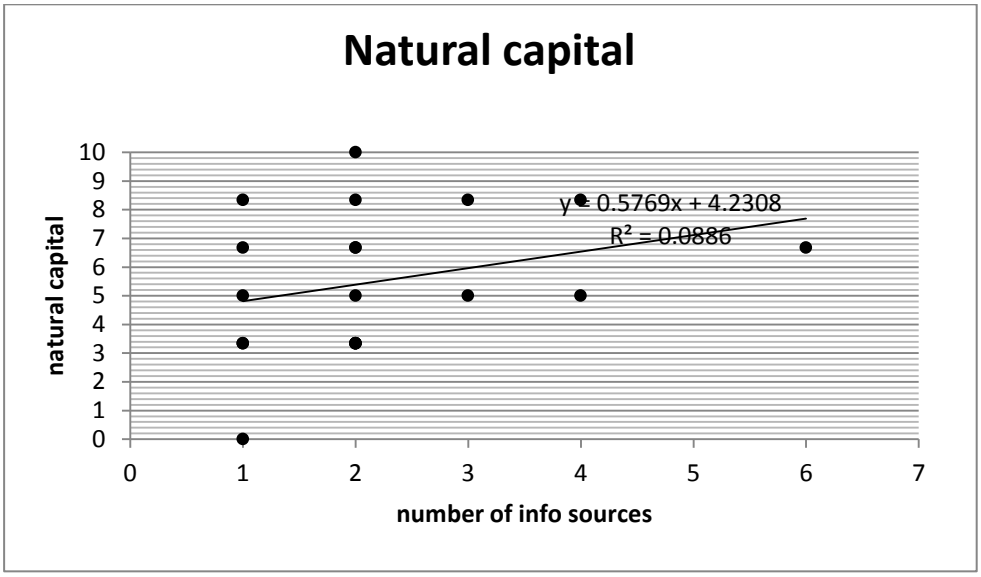


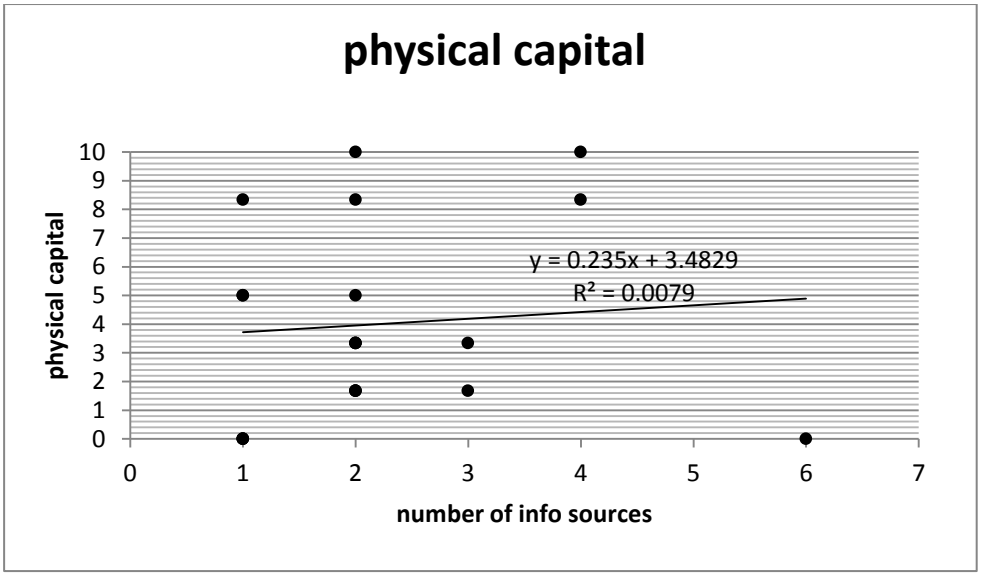

physical capital
physical capital
number of SWC technologies
y = 0.2924x + 2.9766
R² = 0.0223
0
1
2
3
4
5
6
7
8
9
10
0
2
4
6
8

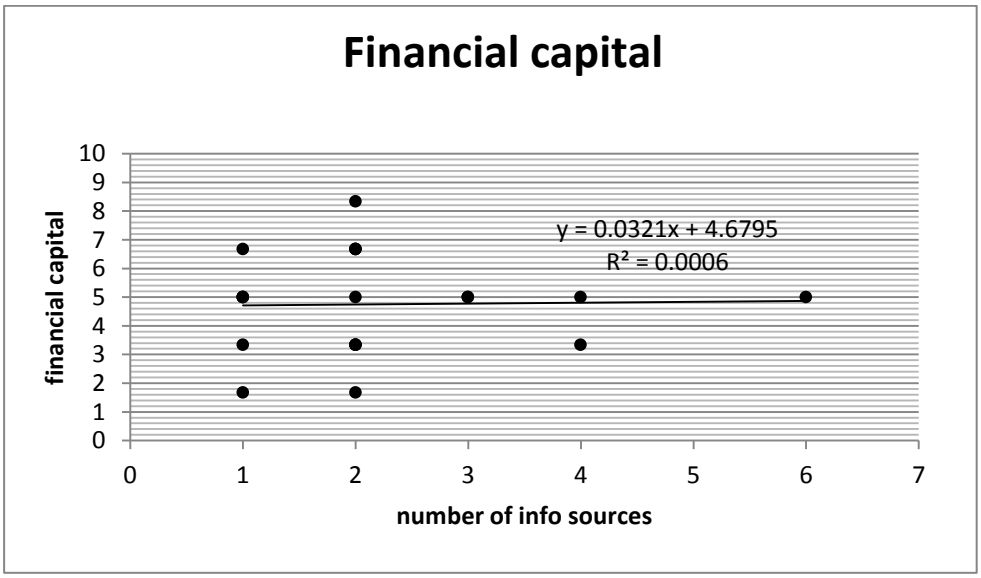

Financial capital
financial capital
number of SWC technologies
y = 0.1316x + 4.2895
R² = 0.0173
0
1
2
3
4
5
6
7
8
9
10
0
2
4
6
8


Total Assets by farmers
Total of Assets
number of SWC technologies
y = 1.4912x + 17.614
R² = 0.0832
0
10
20
30
40
50
0
1
2
3
4
5
6
7
8

A.3: Number of information sources in relation with the farmers assets







A.4: Approaches, Responses of WOCAT Questionnaire, filled out by Department of Forestry, Bandung

Approaches of Agroforestry

1.2.1 Agroforestry
1.2.2 Hutan Rakyat
1.2.3

Name of Technology	**Author**
1. Cultivation	forestry ministries

1.2.4 Mainly on conservation with other activities
1.3.1
Total SLM approach area 16 Ha
1.3.2 See table real
2.1.1 Agroforestry is planting activities in the area of land owned by planting crops such as wood type as well as the principal crop seasons interspersed with intercropping system
2.1.1.2
Aim: optimally utilize the land and cultivating the land according to conservation rules
Method: planting to the type of plants you and interspersed season
Stages of implementation

1. Socialization
2. suitability of land and farmers' surveys
3. The main activities
4. monitoring and evaluation

Role of stakeholder:

1. provider budgets
2. planning function
3. facilitator
4. monitoring and evaluation

Other important information: activities are preferred to optimize the land thus increasing revenue

2.1.1.3
Agroforestry is project/programme based
2.1.1.4 Initiation from 2009

2.1.3.1
The main problem is ineffective land use
2.1.3.2
Social/Cultural/Religious : plant habit, regardless of the conservation rules are still embedded in society (1)

Treatment : understanding the importance of conservation in the use of rules raise
Financial : income people who are still less (2)
Treatment : alternatives given various forestry operations such as bee honey and wood mushrooms
Institutional : handling of critical lands are still less integrated (3)
Treatment : rehabilitation activities involving related steakholder
Legal /Land use and Water right : many people just as sharecroppers (2)
Treatment : land owners to participate in the planting plan
Technical : technology that is traditionally dominated society (2)
Treatment : application of appropriate technology transfer
Workload : wages are given stimulant (2)
Treatment : intercropping system will provide additional income
2.1.4.1. The main objectives of the approach is optimization of land use and increasing farmers' income
2.1.5
By lands user alone (Bottom up)
2.1.5.2.
By land users supported by SLM specialists
2.1.6.1
National specialist
2.2.2.2
Yes, moderate
Because specifications for different jobs work that is roughly done by men
2.2.2.3
No
2.3.1
Government through the regional budget 100 %
2.3.2.1
US$ 10.000 – 100.000
2.4.1.1
Yes for land user
Through the cultivation of forestry operations
2.4.1.2
Demonstration area
2.4.2.1
Name penyuluhan (counseling)
Key element
1. socialization

2. demoplot (demonstration plot)

3. weekly meeting

It is the method used in carrying out extension activities in the field
2.4.3.1
Yes moderate
Sociology, economics/marketing and technology
Research is usually conducted to see how far the changes in the activities implemented
2.5.1.1
Yes, the entire budget comes from government subsidies

2.5.1.2
Rewarded with other material support
Government provides seedlings will be planted by farmers, fertilizer and labor
2.5.2.1
No
2.5.3
Yes great
Local institutions to help in the smooth implementation of the programme, through training and supervision
3.1.2.1
Several
Results of monitoring and evaluation of course there are varying success depending on a problem of each area,
3.1.2.2
Several
Some farmers have felt the benefits of investment made so that they change the pattern of land management with combination of timber crops and crop season
3.2.1.1
Yes moderately
Because aware of the importance of sustainable land management through the planting and the benefits will be felt by their own, farmers continue its pattern of management has been done before
3.2.2.1
Yes, some
Some farmers who farm the land adjacent to implement conservation-based land management systems come interested in the pattern of the other farmers who carried out the counseling done by their field officers tried to follow the pattern
3.2.2.2
Yes, moderately
because the system of land management is to maximize land use with some types of plants that have economic value, this will increase farmers 'income before anything else when the main crop of wood can be harvested in time, would not it increase farmers' incomes
3.2.2.3
No
Because this land management system in addition to consideration for more beneficial aspects of the profits that would automatically attract more farmers

3.2.2.4
Yes, moderately
The addition will significantly influence the reduction in income poverty rates, but that did not happen because the profits will be drastically acquired during the later harvested wood.
3.2.3.3
Moderately
Previous research done enough to help in the effectiveness of activities to be done because it can provide input, how far the success to be achieved
3.2.4.1
Help, greatly
Land owners generally support the program because they realize the importance of the continuation of the results of its land, if managed well
3.2.4.2
Greatly

Because there are still many farmers who do this activity, of course the success of activities carried out is dependent upon the awareness of the owner of the land itself

3.2.5.1

Positive long term impact moderately

Subsidies still have not felt need for independent farmers, but subsidies are granted should be balanced with the contribution of farmers in accordance with its capacity

3.3.1.1

The main motivation:

Increased profit

Farmers want to do the activity essentially because of the increase in income

3.3.1.2

Yes

If the purpose of this activity is carried out properly and the results can be enjoyed, did not rule out this activity can be run without the need to continue to receive assistance from the government.

Strengths/advantages	How can they be sustained/enhanced?
1. budget	the budget for the rehabilitation of critical land to be improved
2. policy	policy to regulate land use so that more attention
3. institutional	institutional extension workers should be in a command with
	Technical institutions

in the land users view

1. farmer groups	farmer groups are institutions that have fostered their independence
2. business	businesses that facilitated the marketing of the crop farmers
3. land owners	assurance of continuity of farming is necessary to protect the
	Continuity of the tiller

Weaknesses	How can they be overcome?
1. technology	applied technology research needs in the field trials
2. experts	experts in forestry and agriculture to be increased in accordance
	Cultivated area ratio

In the land users view

1. human resources	human resources need to be improved

2. land ownership cooperation is relatively narrow land owners need to be improved

Approaches of SekolahLapangKonservasi

1.2.1 Land conservation field school
1.2.2 Sekolahlapangkonservasilahan
1.2.3

Name of Technology	**Author**
1. Understanding the importance of land conservation	department of agriculture, horticulture and Forestry district Bandung

1.2.4 Mainly on conservation with other activities
1.3.1
Total SLM approach area 5 Ha
1.3.2
2.1.1 A field school is one of the field extension methods directly to increase the understanding the importance of the conservation land management
2.1.1.2
Aim: growing understanding of the importance of land management with attention to conservation rules
Method: raining and field demonstrations
Stages of implementation

5. Socialization
6. suitability of land and farmers' surveys
7. The main activities
8. monitoring and evaluation

Role of stakeholder:

5. provider budgets
6. planning function
7. facilitator
8. monitoring and evaluation

Other important information: activities more events aimed to raise the importance of conservation aspects in managing land

2.1.1.3
Agroforestry is project/programme based
2.1.1.4 Initiation from 2009

2.1.3.1
The main problem is lack of awareness of conservation rules in the field
2.1.3.2
Social/Cultural/Religious : plant habit, regardless of the conservation rules are still embedded in society (1)

Treatment : understanding the importance of conservation in the use of rules raise
Financial : income people who are still less (2)
Treatment : alternatives given various forestry operations such as bee honey, wood mushrooms and ornamental plant cultivation
Institutional : handling of critical lands are still less integrated (3)
Treatment : rehabilitation activities involving related stakeholder
Legal /Land use and Water right : many people just as sharecroppers (2)
Treatment : land owners to participate in the planting plan
Technical : technology that is traditionally dominated society (2)
Treatment : application of appropriate technology transfer
Workload : wages are given stimulant (2)
Treatment : intercropping system will provide additional income
2.1.4.1. The main objectives of the approach is growing understanding of land conservation
2.1.5
By lands user alone (Bottom up)
2.1.5.2.
By land users supported by SLM specialists
2.1.6.1
National specialist
2.2.2.2
Yes, moderate
Because specifications for different jobs work that is roughly done by men
2.2.2.3
No
2.3.1
Government through the regional budget 100 %
2.3.2.1
US$ 2.000 – 10.000
2.4.1.1
Yes for land user
Get a good understanding of land management and correct
2.4.1.2
Demonstration area
2.4.2.1
Name penyuluhan (counselling)
Key element
4. socialization

5. dem0plot (demonstration plot)

6. weekly meeting

It is the method used in carrying out extension activities in the field
2.4.3.1
Yes moderate
Sociology, economics/marketing and technology
Research is usually conducted to see how far the changes in the activities implemented
2.5.1.1
Yes, the entire budget comes from government subsidies
2.5.1.2

Rewarded with other material support
Government provides implementation of the field school provides facilities for extension and field practice
2.5.2.1
No
2.5.3
Yes great
Local institutions to help in the smooth implementation of the program, through training and supervision
3.1.2.1
Several
Results of monitoring and evaluation of course there are varying success depending on a problem of each area,
3.1.2.2
Several
Some farmers have realize the importance of conservation for human life and the sustainability of crop production
3.2.1.1
Yes moderately
Because aware of the importance of sustainable land management through the planting and the benefits will be felt by their own, farmers continue its pattern of management has been done before

3.2.2.1
Yes, some
Some farmers who farm the land adjacent to implement conservation-based land management systems come interested in the pattern of the other farmers who carried out the counseling done by their field officers tried to follow the pattern
3.2.2.2
Yes, moderately
Because field school for farmers to realize better in maintaining environmental quality that directly relate to the sustainability of land preparations
3.2.2.3
No
because with more attention to conservation will ensure the sustainability aspects of their lives better
3.2.2.4
Yes, moderately
Through farmer field school equipped with skills in forestry commodity culture so that they will be expanding to increase income
3.2.3.3
Moderately
Previous research done enough to help in the effectiveness of activities to be done because it can provide input, how far the success to be achieved
3.2.4.1
Help, greatly
Land owners generally support the program because they realize the importance of the continuation of the results of its land, if managed well
3.2.4.2
Greatly

Because there are still many farmers who do this activity, of course the success of activities carried out is dependent upon the awareness of the owner of the land itself

3.2.5.1

Positif long term impact moderately

Subsidies still have not felt needs for independent farmers, but subsidies are granted should be balanced with the contribution of farmers in accordance with its capacity

3.3.1.1

The main motivation:

Environmental consciousness, moral, health

farmers realize the importance of conservation for its survival

3.3.1.2

Yes

If the purpose of this activity is carried out properly and the results can be enjoyed, did not rule out this activity can be run without the need to continue to receive assistance from the government.

Strengths/advantages	how can they be sustained/enhanced
4. budget	the budget for the rehabilitation of critical land to be improved
5. policy	policy to regulate land use so that more attention
6. institutional	institutional extension workers should be in a command with technical institutions

in the land users view

4. farmer groups	farmer groups are institutions that have fostered their independence
5. business	businesses that facilitated the marketing of the crop farmers
6. land owners	assurance of continuity of farming is necessary to protect the Continuity of the tiller

Weaknesses	How can they be overcome?
3. technology	applied technology research needs in the field trials
4. experts	experts in forestry and agriculture to be increased in accordance Cultivated area ratio

In the land users view

3. human resources	human resources need to be improved

4. land ownership cooperation is relatively narrow land owners need to be improved

Approaches of GerakanRehabilitasi Lahan Kritis (GRLK)

1.2.1 Critical Land Rehabilitation Movement
1.2.2 GerakanRehabilitasi Lahan Kritis (GRLK)
1.2.3

Name of Technology	**Author**
1. Cultivation	dept. of agriculture, horticulture and forestry district Bandung
2. Technical civil	same as above
3. Community empowerment	same as above

1.2.4 Mainly on conservation with other activities

1.3.1
Total SLM approach area
1.3.2 See table real
2.1.1 GRLK is activities aimed at rehabilitation of critical land areas owned by the community through tree planting and conservation of buildings and the development of forestry operations are financed by government budget
2.1.1.2
Aim is to rehabilitate critical land on land owned by communities and restore the land function
Method: planting with timber plants and multi purpose tree species, building conservation and various forestry operations
Stages of implementation
9. Socialization

10. suitability of land and farmers' surveys

11. institutional training

12. The main activities

13. monitoring and evaluation

Role of stakeholder:
9. provider budgets

10. planning function

11. facilitator

12. monitoring and evaluation

Other important information: preferred activities to foster public awareness of the importance of conservation as well as additional income will be the harvest crops and fruit trees

2.1.1.3
GRLK is project/programme based
2.1.1.4 Initiation from 2003

2.1.3.1
The main problem dependence of society on the budget in the meaning independence of the community is still lacking.
2.1.3.2
Social/Cultural/Religious : plant habit, regardless of the conservation rules are still embedded in society (1)
Treatment : understanding the importance of conservation in the use of rules raise
Financial : income people who are still less (2)
Treatment : alternatives given various forestry operations such as bee honey and wood mushrooms
Institutional : handling of critical lands are still less integrated (3)
Treatment : rehabilitation activities involving related stakeholder
Legal /Land use and Water right : many people just as sharecroppers (2)
Treatment : land owners to participate in the planting plan
Technical : technology that is traditionally dominated society (2)
Treatment : application of appropriate technology transfer
Workload : wages are given stimulant (2)
Treatment : intercropping system will provide additional income
2.1.4.1. The main objectives of the approach is rehabilitation of critical land areas and increasing farmers' income
2.1.5
By lands user alone (Bottom up)
2.1.5.2.
By land users supported by SLM specialists
2.1.6.1
National specialist
2.2.2.2
Yes, moderate
Because specifications for different jobs
Work that is roughly done by men
2.2.2.3
No
2.3.1
Government through the regional budget 100 %
2.3.2.1
US$ 10.000 – 100.000
2.4.1.1
Yes for land user
Through the cultivation of forestry operations
2.4.1.2
Demonstration area
2.4.2.1
Name penyuluhan (counseling)
Key element
7. socialization

8. demoplot (demonstration plot)

9. weekly meeting

It is the method used in carrying out extension activities in the field
2.4.3.1
Yes moderate
Sociology, economics/marketing and technology
Research is usually conducted to see how far the changes in the activities implemented
2.5.1.1
Yes, the entire budget comes from government subsidies
2.5.1.2
Rewarded with other material support
Government provides seedlings will be planted by farmers
2.5.2.1
No
2.5.3
Yes great
local institutions to help in the smooth implementation of the program, through training and supervision
3.1.2.1
Several
Results of monitoring and evaluation of course there are varying success depending on a problem of each area,
3.1.2.2
Several
Some farmers have felt the benefits of investment made so that they change the pattern of land management with due regard to conservation rules
3.2.1.1
Yes moderately
because aware of the importance of sustainable land management through the planting and the benefits will be felt by their own, farmers continue its pattern of management has been done before.
3.2.2.1
Yes, some
some farmers who farm the land adjacent to implement conservation-based land management systems come interested in the pattern of the other farmers who carried out the counseling done by their field officers tried to follow the pattern
3.2.2.2
Yes, moderately
because the system of land management is to maximize land use with some types of plants that have economic value, this will increase farmers 'income before anything else when the main crop of wood can be harvested in time, would not it increase farmers' incomes
3.2.2.3
No
Because this land management system in addition to consideration for conservation attention are also more beneficial aspects of the profits that would automatically attract more farmers
3.2.2.4
Yes, moderately
The addition will significantly influence the reduction in income poverty rates, but that did not happen because the profits will be drastically acquired during the later harvested wood.
3.2.3.3
Moderately
Previous research done enough to help in the effectiveness of activities to be done because it can provide input, how far the success to be achieved

3.2.4.1
Help, greatly
Land owners generally support the program because they realize the importance of the continuation of the results of its land, if managed well
3.2.4.2
Greatly
Because there are still many farmers who do this activity, of course the success of activities carried out is dependent upon the awareness of the owner of the land itself
3.2.5.1
Positive long term impact moderately
Subsidies still have not felt needs for independent farmers, but subsidies are granted should be balanced with the contribution of farmers in accordance with its capacity
3.3.1.1
The main motivation:
Environmental consciousness, moral, health.
Farmers want to do the activity essentially because of the awareness of the importance of environmental improvement as well of course hope the increase in income is also fairly
3.3.1.2
Yes
if the purpose of this activity is carried out properly and the results can be enjoyed, did not rule out this activity can be run without the need to continue to receive assistance from the government.

Strengths/advantages	How can they be sustained/enhanced
7. budget	the budget for the rehabilitation of critical land to be improved
8. policy	policy to regulate land use so that more attention
9. institutional	institutional extension workers should be in a command with Technical institutions

in the land users view

7. farmer groups	farmer groups are institutions that have fostered their independence
8. business	businesses that facilitated the marketing of the crop farmers
9. land owners	assurance of continuity of farming is necessary to protect the Continuity of the tiller

Weaknesses	How can they be overcome?
5. technology	applied technology research needs in the field trials
6. experts	experts in forestry and agriculture to be increased in accordance

5.	human resources	Cultivated area ratio in the land users view human resources need to be improved
6.	land ownership	cooperation is relatively narrow land owners need to be improved

Erklärung

gemäss Art. 28 Abs. 2 RSL 05

Name/Vorname: Andonie Miriam

Matrikelnummer: 04-214-243

Studiengang: Master in geography

Bachelor ☐ Master ☒ Dissertation ☐

Titel der Arbeit: Soil and Water Conservation and Rural Livelihoods in the Upper Citarum Watershed in West Java, Indonesia.

LeiterIn der Arbeit: Prof. H. Hurni, Dr. T. Kohler, Dr. H. Liniger

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31.7.2011

Ort/Datum

M. Andonie

Unterschrift